THE 1996 INTERNATIONAL PIPING PLOVER CENSUS IN CANADA

J. Paul Goossen and Diane L. Amirault (editors)

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THE 1996 INTERNATIONAL PIPING PLOVER CENSUS IN CANADA

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ABSTRACT

During 1996, the second International Piping Plover Census of wintering and nesting areas was conducted across North America. The census provided the first opportunity to accurately determine population trends across the species range.

The 1996 results suggest a slight increase in the overall number of breeding birds in North America during the five-year period between censuses. The North American estimate of breeding birds in 1996 consisted of 5931 individuals, an increase of approximately 8% since 1991. The proportion of birds found in Canada during the breeding season has remained consistent at about 36%, representing 2110 birds of the total number of adult plovers in North America during 1996.

Considerably fewer birds were counted on the wintering grounds in 1996 than in 1991. Only 2515 plovers were observed, encompassing 27% of the numbers counted during the 1991 census. Logistical problems encountered while conducting wintering ground surveys likely contributed to this low count.

In eastern Canada, 422 adult birds were counted during 1996, including 146 in New Brunswick, 104 in Québec (Îles de la Madeleine), 79 in Nova Scotia, 66 in Prince Edward Island and 27 in Newfoundland. Additionally, six were counted in St-Pierre-et-Miquelon (France). The 1996 estimate represents a 17% decrease in numbers compared to 1991. This decline is pronounced in the Maritimes where numbers have dropped by approximately 32%. Numbers elsewhere (Québec, Newfoundland and St-Pierre-et-Miquelon) have actually increased during this period.

In the prairie provinces and Ontario, 1687 birds were counted. Of this number, three birds were found in Ontario, 60 birds in Manitoba, 1348 in Saskatchewan and 276 in Alberta. Overall, numbers in the prairies increased by approximately 17%. Major increases occurred in Alberta (53%) and Saskatchewan (15%), however, fewer birds were counted in Manitoba (-25%) and Ontario (-40%).

Piping Plover protection efforts have continued and in some instances expanded since the first international census. The increase in numbers reported in some parts of Canada may be a response to the increased protection afforded to the species or movement of birds into Canada because of unfavourable habitat conditions in the United States. The decline in some parts of Canada clearly indicates the need to maintain and enhance conservation efforts for the species.

RÉSUMÉ

C'est en 1996 que s'est effectué le second recensement international des zones de nidifications et d'hivernage des pluviers siffleurs en Amérique du Nord. Ce fut l'occasion de déterminer précisément, pour la première fois, les tendances démographiques sur l'ensemble de l'aire de distribution de l'espèce.

Les résultats obtenus en 1996 indiquent une légère augmentation du nombre total des spécimens nichant en Amérique du Nord sur la période de cinq ans qui sépare les deux recensements : 5945 individus, soit une augmentation d'approximativement 8 % par rapport à l'effectif de 1991. La proportion d'oiseaux observés au Canada pendant la saison de nidification est restée stable, autour de 36 %, ce qui représentait 2110 pluviers adultes en 1996.

On a recensé beaucoup moins d'oiseaux sur les zones d'hivernage en 1996 qu'en 1991 : seulement 2515 pluviers ont en effet été observés en 1996, soit 27 % de l'effectif observé en 1991. Les problèmes logistiques qui ont gêné les recensements hivernaux sur le terrain ont probablement influencé ce résultat.

Dans l'Est du Canada, 422 oiseaux adultes ont été comptés en 1996, dont 146 au Nouveau-Brunswick, 104 au Québec (îles de la Madeleine), 79 en Nouvelle-Écosse, 66 dans l'Île du Prince-Édouard et 27 à Terre-Neuve. On a de plus observé 6 oiseaux à St-Pierre et Miquelon (France). Les estimations de 1996 suggèrent une diminution de 17 % par rapport à l'effectif de 1991. Ce déclin est prononcé dans les Maritimes où les effectifs ont diminué d'environ 32 %. Ailleurs (au Québec, à Terre-Neuve et à St Pierre et Miquelon, les effectifs ont en fait augmenté durant la même période.

On a par ailleurs recensé 1687 oiseaux dans les provinces des prairies et en Ontario, dont 3 oiseaux en Ontario, 60 oiseaux au Manitoba, 1348 en Saskatchewan et 276 en Alberta. Globalement, l'effectif pour cette région a augmenté d'approximativement 17 %. Les augmentations les plus importantes ont eu lieu en Alberta (53 %) et en Saskatchewan (15 %), tandis qu'on a constaté une diminution des effectifs au Manitoba (-25 %) et en Ontario (-40 %).

Les efforts de protection du Pluvier siffleur se poursuivent et ont dans certains cas été intensifiés depuis le dernier recensement international. L'augmentation des effectifs constatée dans certaines régions du Canada peut traduire l'effet d'une protection accrue accordée à l'espèce ou l'arrivée d'oiseaux des États-Unis à cause de conditions de conditions d'habitat défavorables au sud de la frontière. Les déclins observés dans certaines partie du Canada indiquent clairement qu'il est nécessaire de maintenir et même parfois d'intensifier les efforts de conservation de cette espèce.

ACKNOWLEDGEMENTS

The completion of the 1996 International Piping Plover Census and subsequent compilation of information presented within this publication would not have been possible without the contributions of many volunteers, non-government organizations, provincial and federal agencies. Their tireless effort and interest has enabled us to assess for the second time the Canadian Piping Plover population. For their efforts and for the continued interest in Piping Plover conservation initiatives, we express our sincere gratitude.

For their role in organizing and conducting the 1996 census and preparing chapters for inclusion into this report, we acknowledge the following organizations: Newfoundland and Labrador Department of Forest Resources and Agrifoods, Nova Scotia Department of Natural Resources, New Brunswick Department of Natural Resources and Energy, Prince Edward Island Nature Trust, Québec- Ministère de l'environnement et de la faune, Ontario Ministry of Natural Resources, Manitoba Conservation (formerly Manitoba Department of Natural Resources), Saskatchewan Environment (formerly Saskatchewan Environment and Resource Management), Saskatchewan Wetland Conservation Corporation, Alberta Sustainable Resource Development (formerly Alberta Department of Environmental Protection), Canadian Wildlife Service, Parks Canada (Department of Canadian Heritage), United States Geological Survey - Biological Resources Division. The assistance of Julie McKnight, Rachel Gautreau and Andrew Boyne in editing and compilation of the Eastern Canada component is gratefully acknowledged. We thank Christine Scott, Sharilyn Westworth, Diane Martens and Valorie Goossen for their assistance in the preparation of the manuscript.

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1.0 INTRODUCTION

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In Canada, conservation of the endangered Piping Plover *Charadrius melodus* remains the focus of many groups. The efforts of various federal, provincial and non-government groups are planned according to goals and priorities established by two separate recovery teams: the Eastern Canada Team leads efforts to protect Piping Plovers in the Atlantic provinces and Québec; and the Prairie Team leads efforts for the Prairie provinces and Ontario.

Conservation efforts

Many strategies have been used to protect Piping Plovers across their Canadian range. Efforts to minimize negative impacts of human disturbance have been the focus of many efforts in Eastern Canada. Public education has been a particularly strong component of recovery actions. Various brochures, newspaper articles and other educational materials have been developed and widely distributed. A Piping Plover Guardian Program, aimed at educating beach users, was established in order to modify potentially harmful human behaviours. The use of symbolic fencing and signage in areas of particularly heavy human disturbance helps to steer beach users away from sensitive nesting sites. The establishment and enforcement of laws and regulations prohibiting the use of all-terrain vehicles on beaches has proven successful in some locations, however this problem persists in many parts of Eastern Canada. Some protected areas have been strategically located to help protect nesting populations of Piping Plovers. In Eastern Canada, Piping Plovers nest in three national parks, one national wildlife area, and several other protected areas such as provincial parks, ecological reserves and Western Hemisphere Shorebird Endangered Species Reserves. A high level of protection is afforded to nesting populations within national parks. In these areas, complete closure of the beach during the nesting season and close monitoring of nesting birds is possible. Eggs collected from abandoned nests are used for fostering into nests when the age of the eggs can be matched closely to those of the original nest. This practice is only adopted for those territorial pairs which lose their nests and are given clay eggs to incubate or those pairs needing to complete a full clutch. Eggs that cannot be fostered are retained for examination to identify abnormalities in embryonic development, for use in DNA studies and analyzed for toxic chemical levels. Programs of predator management and predator exclosures are also often used in national parks. Annual counts of nesting birds occur at most known sites in the Atlantic range.

In the prairie provinces, Piping Plovers do not encounter as much public disturbance as they do in Eastern Canada and therefore conservation efforts have concentrated on habitat protection and reducing the impacts of predators. Fencing projects have kept cattle off beaches to eliminate or reduce disruption to habitat substrates used by plovers. Negotiations and mitigative planning continues in an effort to reduce the negative effects that water management projects have on nesting and chick-rearing habitat. Predator exclosures are used to protect eggs in several provinces, including northwestern Ontario, with the goal of increasing Piping Plover productivity. Monitoring populations at specific sites continues to provide biologists with information on population fluctuations. Habitat and breeding ecology studies have not only provided greater insight into the plover's natural history but also laid a foundation to aid conservation planning. Public education has also been part of the conservation strategy for the prairie population and has been facilitated through various media and direct personal contacts. The recognition of Piping Plover nesting sites has been profiled through special conservation area and Western Hemisphere Shorebird Reserve Network endangered species site designation. Agency co-operation is an important factor in broadening the scope of conservation actions.

The Species at Risk Act (SARA) received Royal Assent in December 2002. When proclaimed, SARA should eventually result in increased protection for any endangered species and their habitats found on federal lands, as well as enhanced protection of migratory bird nests elsewhere. The role of the Committee on the Status of Endangered Wildlife in Canada as well as the list of species at risk will also become established through legislation. In conjunction with the federal SARA, a National Accord for the protection of species at risk was informally adopted by the federal government, provinces and territories. One element of the National Accord recommends the development of complimentary provincial legislation for the protection of species at risk on provincial crown and private lands. Once finalized and implemented, these efforts should enhance the level of protection for the Piping Plover.

Need for periodic population censuses

Although population censuses were conducted in North America prior to 1991, these were scattered and sometimes irregular. Past focus has also been on specific areas in Canada and did not permit a reliable assessment of population size over the entire species range. The 1991 International Piping Plover Census provided a benchmark census of all known and potential habitats, and resulted in the most reliable population estimate ever produced for the Piping Plover (5484 adults). Repeating this comprehensive census periodically is important for monitoring the status of the international and regional populations as well as assessing the success of conservation programs. The 1996 International Piping Plover Census provides the first opportunity to clearly identify trends in Piping Plover populations.

The objectives of this occasional paper are to ensure that results of the second international census carried out in 1996 are readily available, to analyze population trends since the last international census and discuss progress on conservation efforts since 1991.

2.0 REGIONAL CENSUS RESULTS

2.1 The 1996 Piping Plover census in Newfoundland and St-Pierre-et-Miquelon (France)

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Abstract

The 1996 International Piping Plover Census took place from 5-17 June in Newfoundland and St-Pierre-et-Miquelon. Twenty sites were surveyed in Newfoundland and three sites were surveyed in St-Pierre-et-Miquelon combining to cover 70.75 km of coastline. Piping Plovers were found at seven sites in Newfoundland and one site on Miquelon. Piping Plovers increased in Newfoundland from seven adults in 1991 to 27 adults in 1996. Most of this increase can be attributed to an increase in the number of sites surveyed. In St-Pierre-et-Miquelon, six Piping Plovers were observed in 1996 while in 1991 only four adults were counted. In both Newfoundland and St-Pierre-et-Miquelon, human disturbance still affects the Piping Plovers. In Newfoundland, 63% of the plovers were observed in areas where they were afforded some form of habitat protection.

Résumé

À Terre-Neuve et à Saint-Pierre-et-Miquelon, le Recensement international des Pluviers siffleurs de 1996 a eu lieu du 5 au 17 juin. Les participants ont visité 20 sites à Terre-Neuve et 3 sites à Saint-Pierre-et-Miquelon, ce qui représente une zone littorale de 70,75 km au total. Ils ont observé des représentants de l'espèce à sept endroits dans la province et à un endroit sur l' île de Miquelon. À Terre-Neuve, on a recensé 27 individus en 1996, alors qu'on n'en avait dénombré que sept en 1991. Ces hausses peuvent être

attribuées en majeure partie à l'augmentation du nombre de sites visités. Dans le cas de Saint-Pierre-et-Miquelon, on en a compté six en 1996, par rapport à quatre en 1991Dans les deux régions, le Pluvier siffleur subit encore des perturbations anthropiques. À Terre-Neuve, 63 % des oiseaux ont été observés dans des zones où l'habitat bénéficiait d'une certaine forme de protection.

Introduction

Piping Plovers *Charadrius melodus* have been recorded in Newfoundland since at least 1911 (R. H. Howe *in* Peters and Burleigh 1951) and have been described as fairly common summer residents on the beaches of southwestern Newfoundland (Peters and Burleigh 1951). It is however also suggested that the Piping Plover has never been numerous (Knox et al. 1994) in the province. The population in the late 1970s was thought to be 10-15 pairs (R. Lamberton and S. Tingley pers. comm. *in* Cairns and McLaren 1980). In the past 25 years, plovers have also been reported from the northeast coast (Brazil 1983; Brazil 1984; R. Montgomerie *in* Cairns and McLaren 1980), and in the Cape Freels area although their presence has been sporadic (J. Brazil, unpubl. files). Most past and present plover areas are found in the west coast climatic zone (Banfield 1983) which is characterized by relatively early springs, moderately warm and sunny summers and annual rainfall amounts of 1000-1200 mm. South and northeast coast sites are characterized by later springs and cool to moderate summers. Sea ice may persist on the northeast coast until mid-May.

The first record of Piping Plovers in St-Pierre-et-Miquelon was a single bird in 1983. A single bird was also observed in 1984 and breeding was confirmed in 1985 when two adults were observed with a chick. Plovers were not observed again until a nest was found with four eggs in 1990.

Methods

As in 1991, the Inland Fish and Wildlife Division, Department of Forest Resources and Agrifoods, coordinated the Newfoundland survey for Piping Plovers while Roger Etcheberry coordinated surveys on St-Pierre-et-Miquelon. Division staff, Gros Morne National Park personnel and volunteers who were able to identify plovers were contacted to participate in the surveys. Groups were assigned to specific beaches to ensure no beach was missed. Beaches selected for censusing were those with historical or recent evidence of plover activity and beaches which were thought to have potential nesting habitat.

In Newfoundland, beach surveys were to be conducted from 1-15 June 1996, with a minimum of two surveyors per beach. When possible, surveys were conducted during a period of low to mid tide, calm conditions, clear or partly cloudy skies and air temperatures in excess of 10°C. All surveys were carried out on foot with two sweeps of the beach, associated dunes and backwash areas giving what the observers felt would be 100% coverage. When birds were found the observers made a point to reduce disturbance by moving quickly through the territory. When a bird was seen leaving a nest, it was checked quickly for contents. In all cases the welfare of the adults, eggs or young was given priority. Information recorded included date, location, habitat description, number of paired and single adults, number of chicks, behaviour of the birds, number of nests and number of eggs. Also recorded were local weather conditions, distance surveyed and other information as may have been appropriate. When a beach was surveyed more than once, the higher number of adults, pairs, eggs or young from a particular survey was the number reported for that beach.

On St-Pierre-et-Miquelon, surveys were conducted from 7-17 June at three sites on the island of Miquelon. The same areas were surveyed in 1996 as were surveyed in 1991, however two sites from the 1991 census, Southeast Beach and South Part of Isthmus, were combined to form one site, the Isthmus of Langlade, in 1996. Two observers surveyed the Isthmus of Langlade while only one surveyed the Gully of Grand Barachois and the Dune of Miquelon. The west side of the Isthmus of Langlade was visited 10 and 17 June and the east side was visited 14, 16 and 17 June. When the number of birds differed between surveys, the larger number of birds was reported.

Results

In total, 23 beaches (Table 1) were checked by 19 surveyors between 5-17 June 1996, in Newfoundland and St-Pierre-et-Miquelon. The total length of surveyed beaches was 70.75 km (47.25 km in Newfoundland and 23.5 km in St-Pierre-et-Miquelon). In Newfoundland, 11 beaches were on the west and southwest coasts, three on the south coast and six on the northeast coast (Fig. 1).

Twenty-seven adults were seen on seven beaches on the southwest coast. Eight nests were found which contained a total of 30 eggs. Another three territorial pair were seen but no nests were found. There were 10 beaches surveyed in 1991 which were also surveyed in 1996. Nine plovers were found on three of those 10 beaches in 1996 while only seven plovers were found on one of those same beaches in 1991. Human disturbance varied considerably between beaches.

Piping Plovers were only found at the Isthmus of Langlade on Miquelon (Fig. 2). One pair was found on the west side and two pairs on the east side of the Isthmus. Both pairs on the east side failed to nest, however the single pair on the west side was observed on 19 June, with three chicks that were several days old.

Discussion

Most of the increase in plover numbers from 1991 (seven adults) to 1996 (27 adults) in Newfoundland, can be attributed to additional beaches being surveyed. These 'new' beaches had 18 of the 27 adults found in 1996. The 'new' beaches at Grand Bay and Cheeseman Park were reported to us in 1992 and have been monitored since then. Piping Plovers have been known, by local people, to have frequented those beaches for a number of years. Comparisons of beaches surveyed in both years seem to indicate a slight increase in the population as well as a greater increase in plover distribution. While only six pairs were clearly identified in Newfoundland, a minimum of 11 pairs (at least during courtship and egg laying) must have been present based on the number of nests found being attended by only one bird.

No birds were found on the northeast coast where birds were last seen in 1987 (J. Brazil, unpubl. files). The beaches on the northeast coast are hundreds of kilometres from the current plover population. There is little good nesting habitat in between therefore it seems unlikely that birds will naturally recolonize the area.

Three of the sites in Newfoundland, containing a total of 17 adults (63% of all birds seen), are afforded some form of habitat protection. One site, Big Barasway, is a Wildlife Preserve specifically set up to protect Piping Plovers. The other two sites are within provincial parks and can be protected by parks staff. Little if any disturbance was noted at Big Barasway. Low levels of disturbance were noted in the parks however active protection of the nests in Cheeseman Park was ongoing. The other major site was the three beaches at Grand Bay. Disturbance here was at times high with the beach closest to the community of Grand Bay West having the highest level of human activity. A plover guardian program has been active in this area and fledged young have been seen. Disturbance levels at the beaches where no plovers were found were similar to levels on beaches containing plovers.

Disturbance in the nesting areas continues to be a problem on Miquelon with off road vehicles (not all-terrain vehicles), motorbikes and pedestrians, sometimes with dogs, commonly frequenting the beaches. Gulls (*Larus spp.*) continue to nest at nearby Grand Barachois. Suitable habitat, with little human disturbance, is present at the Gully of Grand Barachois, however, Piping Plovers have never been observed in this area. The beaches on Miquelon have been censused every year from 1991-1996. The most successful year was in 1995 when there were three pairs with a total of 11 chicks (Table 2).

Acknowledgments

The authors wish to express their appreciation to the following people who helped conduct the 1996 survey: Doug Ballam, Peter Earle, Alfred Gillis, Bill Greene, Paul Linegar, Lem Mayo, Bill Montevecchi, Mike O'Callaghan, Derek Osbourne, John Pratt, Jytte Selmø, Leah Soper, and Ward Strickland. Thanks also to Tammy Joyce who assisted with the graphic. We would also like to thank Lawrence Karasek, Richard Osmond, Irving Seaward and others from the Grand Bay area who alerted us to the plovers in the area and have been part of the monitoring and protection effort. Finally this paper is dedicated to the memory of Peter St. Croix who assisted in the surveys of plovers at Sandy Point and Stephenville Crossing and who for years championed the cause of conservation in those areas. On Miquelon, Laurent Jackman and Danielle LeBollocq assisted with the surveys.

Figure 1. Location of sites censused in Newfoundland during the 1996 International Piping Plover Census.

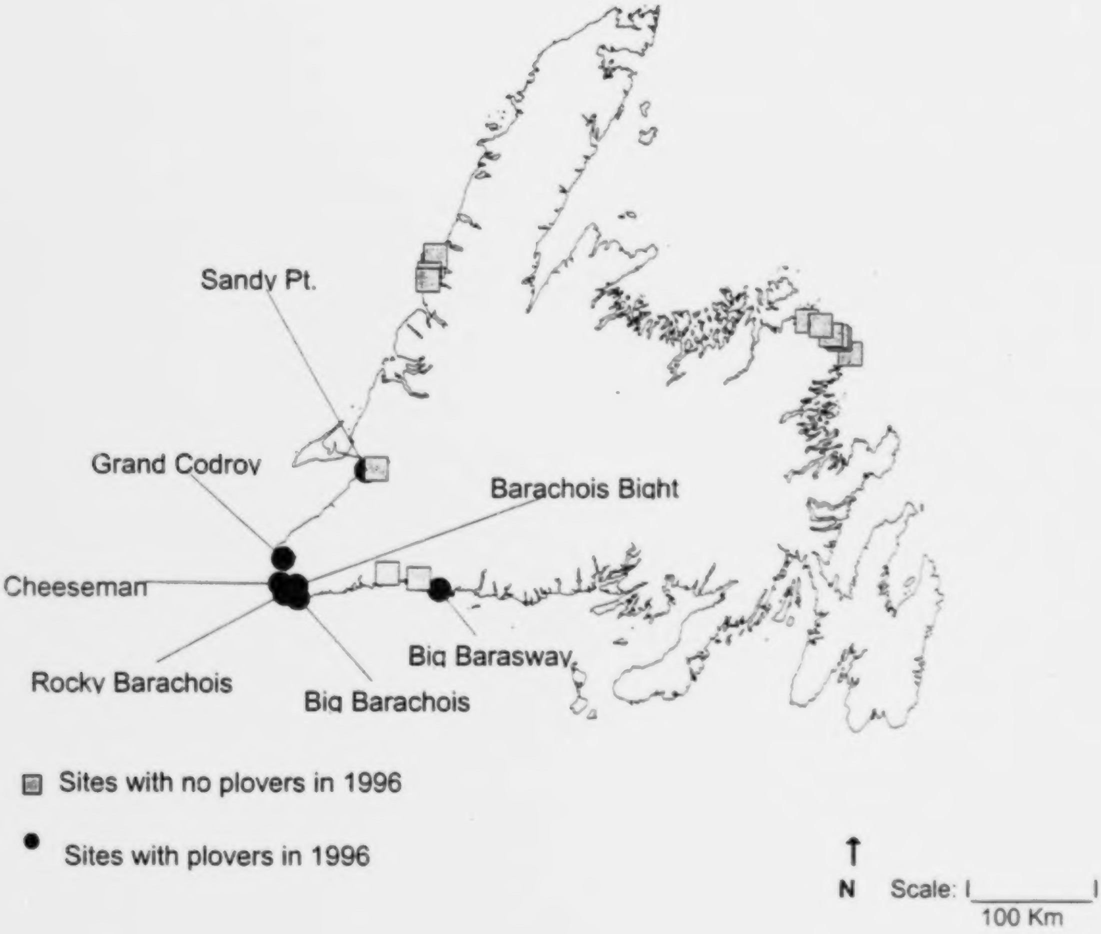
Sandy Pt.
Grand Codroy
Barachois Bight
Cheeseman
Rocky Barachois
Big Barachois
Big Barasway
▨ Sites with no plovers in 1996
● Sites with plovers in 1996
N
Scale:
100 Km

Figure 2. Location of sites censused on St-Pierre-et-Miquelon (France) during the 1996 International Piping Plover Census.

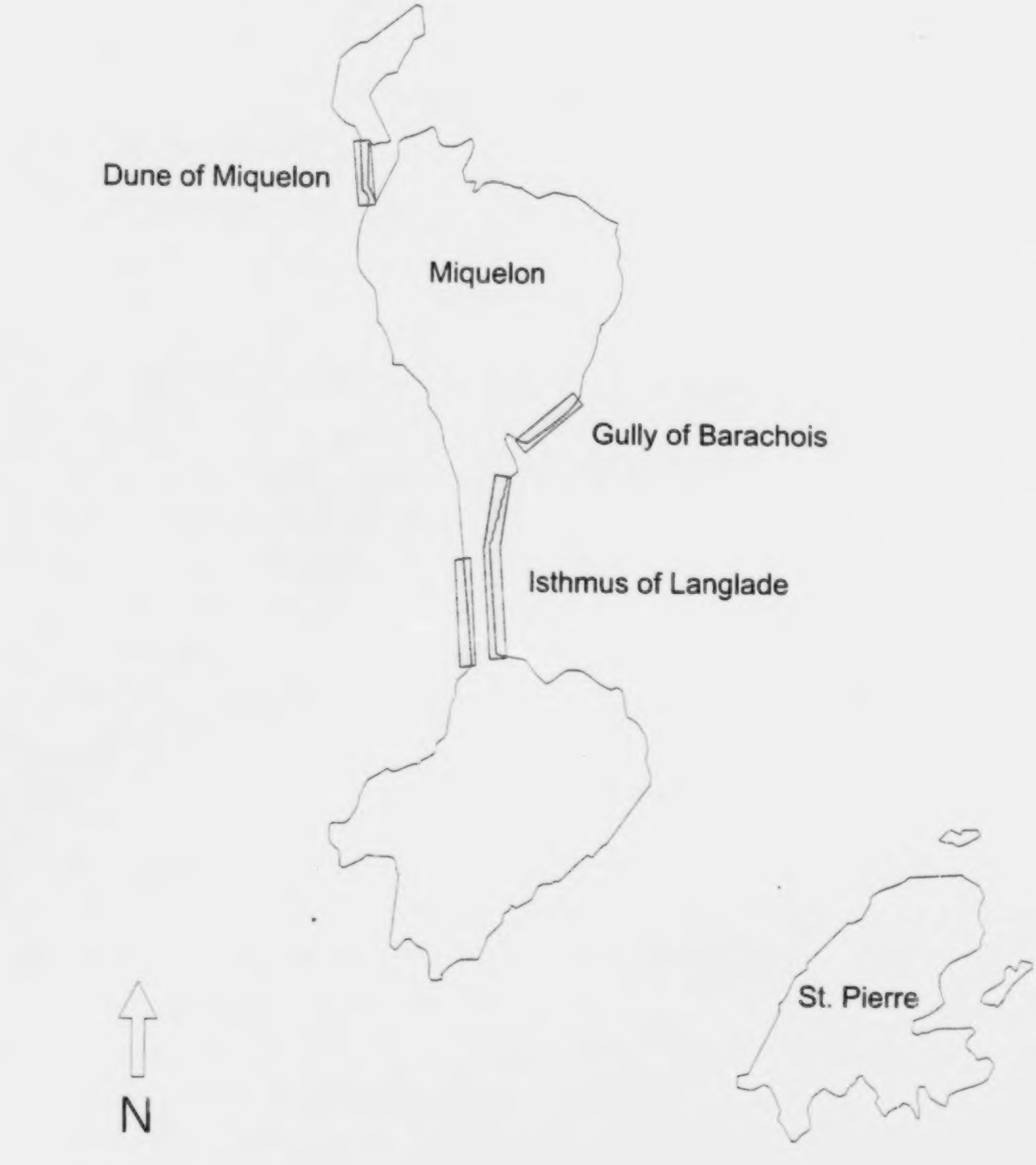
Dune of Miquelon
Miquelon
Gully of Barachois
Isthmus of Langlade
St. Pierre
N
Scale: I______I
5 km

Table 1. 1996 Piping Plover *Charadrius melodus* census results, Newfoundland and St-Pierre-et- Miquelon (France).

Date	Location	Adults	Pairs	Eggs	Distance covered (km)
Newfoundland					
7 June	Sandy Point	2			4.0
6 June	Grand Bay - Barachois Bight	4	2	7	1.5
6 June	Grand Bay - Rocky Barachois	1		4	1.0
6 June	Grand Bay – Big Barachois	3	1	3	3.0
6 June	Cheeseman Park	10		16	2.0
14 June	St. Pauls	0			4.9
12 June	Broom Point	0			1.0
7 June	Big Barasway	5	2		3.5
13 June	Grand Codroy	2	1		2.0
17 June	Bakers Spit	0			1.0
17 June	Connoire Spit	0			1.0
6 June	Stephenville Crossing	0			5.0
5 June	Shallow Bay	0			4.0
14 June	Western Brk.	0			2.0
13 June	Musgrave Harbour	0			3.6
13 June	Shalloway Brk.	0			0.75
13 June	Lumsden West	0			2.0
13 June	Lumsden East	0			1.0
14 June	Deadman's Bay	0			2.0
14 June	Cape Freels	0			2.0
St- Pierre-et-Miquelon					
7 June	Gully of Grand Barachois (Miquelon)	0			3.0
10 June	Isthmus of Langlade (Miquelon)	6	3	3	14.0
17 June	Dune of Miquelon (Northwest Beach; Miquelon)	0			6.5
Total Newfoundland		27	6	30	47.25
Total St-Pierre-et-Miquelon		6	3	3	23.5

Table 2. Piping Plover survey results in St-Pierre-et-Miquelon,1991-1996.

Year	Number of adults	Number of chicks
1991	4	
1992	3	
1993	2	2
1994	2	4
1995	6	11
1996	6	3

2.2 The 1991 Piping Plover census in Nova Scotia

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Abstract

During the 1996 International Piping Plover Census, 79 plovers were counted at 25 beaches in Nova Scotia (including 33 pairs and 13 singles). This number represents a decrease (-19 pairs, -34 individuals) from the 113 birds counted in the 1991 International Piping Plover census. Winter storm damage and increased human disturbance during the critical nesting period have been indicated as factors in the decline of plovers and low productivity in Nova Scotia.

Résumé

Pendant le dénombrement international des Pluviers siffleurs de 1996, 79 individus ont été observés sur 25 plages de Nouvelle-Écosse (dont 33 paires et 13 individus seuls). Il s'agit d'une baisse (-19 paires, -34 individus) par rapport aux 113 Pluviers siffleurs recensés pendant le dénombrement international des Pluviers siffleurs de 1991. Des dommages imputables à des tempêtes hivernales et une augmentation de la perturbation par l'homme pendant la période critique de la nidification sont considérés comme des facteurs du déclin des Pluviers siffleurs et de leur faible productivité en Nouvelle-Écosse.

Introduction

The Nova Scotia Department of Natural Resources (NSDNR) staff and volunteers have collected information on abundance and distribution of Piping Plovers and, where possible, reproductive data on selected beaches between 1991 and 1996. The first 'mini-census' (a less intense survey scheduled during intervening International Piping Plover Census years) of Piping Plovers was conducted in Nova Scotia in 1994. The purpose of this survey was to gather information on numbers of Piping Plover breeding pairs and unpaired adults between Census years at sites where Piping Plovers were previously observed. This census was an effort undertaken to document changes in distribution and abundance of plovers between International Piping Plover Census years and to add to the long-term information being gathered on plovers every five years.

Piping Plovers in Nova Scotia received added protection with the initiation of a volunteer-based effort, the Nova Scotia Piping Plover Guardian Program, in 1992. The Piping Plover Guardian Program was established to reduce human disturbance to Piping Plovers at breeding sites outside Kejimkujik National Park. The program was successful in areas with a good volunteer base but due to the unpredictable nature of volunteers and the lack of participants in some areas, critical plover habitats went unprotected.

Here, we report the outcome of the 1994 'mini-census' and detail the results gathered during the 1996 Nova Scotia Provincial Census conducted by NSDNR, Parks Canada and the Nova Scotia Piping Plover Guardians.

Methods

1994 'mini-census'

The 1994 'mini-census' was conducted in Nova Scotia from 6-10 June. NSDNR designated 28 sites to be checked, however two beaches were not reached due to time and manpower constraints. Nesting data were collected at 13 sites. Investigators followed nesting pairs until the result of a nesting attempt was determined and outcome of young was ascertained at 18 to 20 days or when young were observed in sustained (>15 m) flight. Productivity was calculated as the number of fledged young per pair.

1996 International Piping Plover Census

Suitable sites (n = 102) were chosen based on 1991 census lists and results. Sites were added and removed from the list based on information (on beach suitability) arising from the 1991 International Piping Plover Census, the 1994 'mini-census' and observations reported by NSDNR Regional Biologists and local naturalists.

Information and guidelines, as well as a list of beaches and Piping Plover census sheets, were sent out by the Nova Scotia Provincial Coordinator (Pamela Mills). Forty individuals spent over 115 hr surveying sites for the 1996 census. Participants and partners were associated with NSDNR (District Office and Wildlife Division staff), Canadian Wildlife Service, Parks Canada (Kejimkujik National Park – Seaside Adjunct), Piping Plover Guardian Program volunteers, Halifax Field Naturalists, Pictou County Field Naturalists, Eastern Mainland Field Naturalists and other individuals.

A total of 101 beaches were surveyed for the 1996 International Piping Plover Census. Of these, 16 were new sites added to the list since the 1991 census. All but one site surveyed in the previous census was revisited. This beach, Blanche Point, Blanche Island was missed due to inclement weather and time constraints.

The International Piping Plover Census was completed in Nova Scotia during 1–21 June (Table 1). The official census period was to be 1-9 June, but allowing for time, weather and access constraints, data collected between 10-16 June were included as well. Some deviations from the census period were reported. Baltee Island (Romkey's Point) and Sandy Cove (including Eastern Sandy Cove) beaches were censused outside the official census period on 21 June. Reported weather conditions for surveys were satisfactory. Most counts were conducted under clear, partly cloudy or overcast skies with calm or moderate breezes.

Nesting data were collected at six sites. Investigators followed nesting pairs until the result of a nesting attempt was determined and outcome of young was ascertained at 18 to 20 days or when young were observed in sustained (>15 m) flight. Productivity was calculated as the number of fledged young per pair.

Results

1994 'mini-census'

During the 1994 'mini-census', investigators observed a total of 80 plovers (consisting of 36 pairs, 8 singles) on 20 beaches. A pair of breeding plovers was observed at Ragged Harbour Beach in 1994. This beach had not been previously visited during the 1991 International Piping Plover Census.

Reproductive data was collected at 13 sites in 1994. Of the known nesting attempts, hatching success was 0.32 (9 of 28 nests successful) and productivity was calculated to be 0.48 chicks fledged per pair (approximately one chick fledged for every two pairs).

1996 International Piping Plover Census

Seventy-nine plovers (comprised of 33 pairs) were counted at 25 sites during the 1996 International Piping Plover Census. Eighteen of these sites were located on the South Shore (Lunenburg (2), Queens (7) and Shelburne (9) counties) of Nova Scotia, and the other seven records occurred in Antigonish (3), Cumberland (1), Halifax (1), Pictou (1) and Victoria (1) counties. Unsuitable or poor nesting habitat was reported at 13 of the 99 beaches surveyed in 1996.

A few differences were noted in relation to the distribution of plovers in 1996 from the previous census (Table 2). Several beaches where Piping Plovers were observed in 1991 did not have birds in 1996. These 18 sites were: Dominion (Lingan), Clam Harbour, Conrads (East and West), Martinique, Rainbow Haven Park (Cole Harbour), Stoney (Lawrencetown Head), James & Little Harbour Spit, Pictou Bar Spit (Lighthouse), Cranberry Pond, Little Port Joli Bay, Kejimkujik National Park , Port Joli (Goose Haven), Black Point (Mathews Lake), Burks Point (Powells), Clam Point, Goose (Indian) Point, Inner (The Cape), Northeast Point and Red Head. Birds were present at Captains Pond and Monks Head, Mahoney's, Oak Island, Conrods, Petpeswick Inlet, Port Mouton Island and South Harbour in 1996 but not in the previous census in 1991.

This year, a total of 28 nesting attempts were recorded at 13 sites. Of these attempts, 18 nests (resulting from 15 pairs) were intensively monitored at 6 sites to gather nesting and fledging productivity data (Table 3). Thirty-seven young were observed to fledge from 12 successful nests. Average productivity from the 6 sites was 3.10 young fledged per pair.

Discussion

A substantial decrease (-19 pairs, -34 adults) in the number of plovers on Nova Scotia's beaches was observed when comparing the 1996 and 1991 International Piping Plover Census data (i.e. 79 adults in 1996 versus 113 in 1991). Distributional changes were notable; the number of occupied beaches declined since the 1991 census (35 in 1991 and 25 in 1996). Eighteen sites previously occupied by plovers in 1991 did not support plovers in 1996. Major site losses occurred in Shelburne (7 sites) and Halifax (5 sites) counties. Six sites gained plovers in 1996. Gains occurred in Antigonish (2 sites), Cumberland (1 site), Halifax (1 site), Queens (1 site) and Victoria (1 site) counties.

A decline of 33 adults (representing 16 pairs) was observed from 1991 to 1994, however, 14 plover beaches were not rechecked in 1994. There was little change in abundance of plovers on beaches surveyed in both years (n=29). Therefore, the observed decline is likely not a real decline, but rather resulting from a lack of data due to sites missed in 1994. A further decline (-3 pairs, -1 adults) was observed from the 1994 'mini-census' to the 1996 International Piping Plover Census. When considering only the beaches surveyed in both 1994 and 1996, a considerable decline (-12 pairs, -23 adults) was evident. Pairs were missed during the 1994 'mini-census' (on the 14 known plover sites not censused), and if we assume that the decline on beaches missed in 1994 was similar to the decline at observed sites, then the decline from 1994 to 1996 was likely severe. The decline from 1994 to 1996 cannot be explained by pair redistribution, as all sites surveyed in 1991 and 1994 were revisited (but one, Blanche Point, where plovers have never been observed) in 1996 and 16 new sites were checked for the presence of plovers.

Winter storm damage is one factor that has been blamed for the substantial decline in plover numbers (NSDNR unpubl. data). During the 1994 'mini-census', it was noted that 'a number of beaches have lost all nesting habitat over the winter; the water, at high tide, now covers all the beach area to the vegetated dunes and only leaves unsuitable habitat above the high water mark. Other beaches have become smaller (narrower) leaving less nesting area available." Also noted during the 'mini-census' was the increase in human activity on the beach. It was hypothesized that early good weather in 1994 brought visitors to the beach earlier and in larger numbers than expected. Human tracks and vehicle tread marks were noted in excess at some beaches in suitable nesting habitat where plovers have been known to nest in the past. The increase in human disturbance almost certainly caused nest, and possibly site, abandonment and contributed to the poor nesting and fledging success in 1994.

The high productivity this year (1996) is encouraging. Symbolic fencing and predator exclosures were used this year to protect nests in Queens County, with seemingly great success (NSDNR unpubl. data). Monitoring of selected beach sites and consistent collection of reproductive data at these sites is planned on a continuing yearly basis. The use of symbolic fencing and predator exclosures will be continued and expanded where feasible.

Acknowledgements

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Figure 1. Location of sites censused in Nova Scotia during the 1996 International Piping Plover Census.

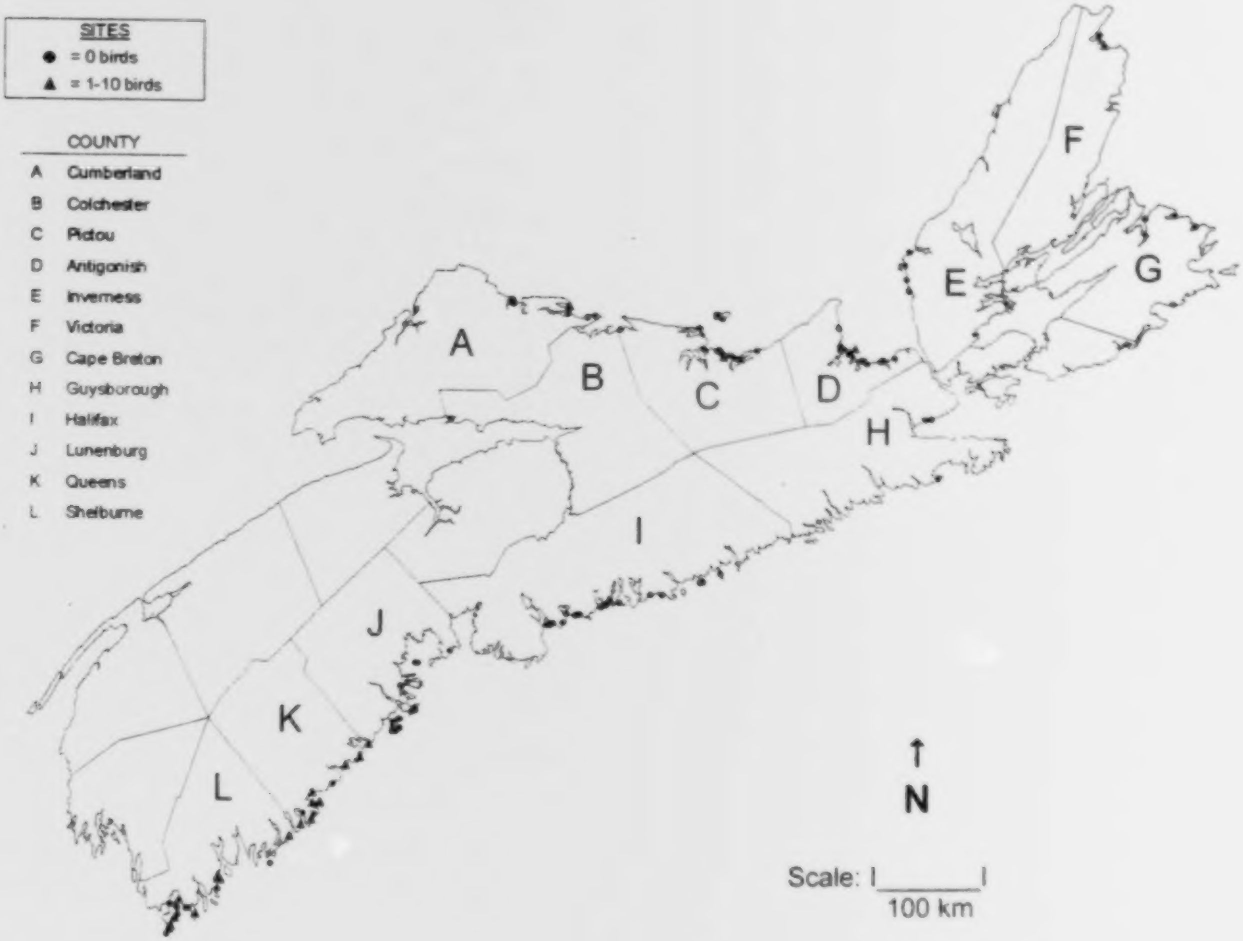
SITES
● = 0 birds
▲ = 1-10 birds
COUNTY
A Cumberland
B Colchester
C Pictou
D Antigonish
E Inverness
F Victoria
G Cape Breton
H Guysborough
I Halifax
J Lunenburg
K Queens
L Shelburne
A
B
C
D
E
F
G
H
I
J
K
L
N
Scale: I_______I
100 km

Table 1. Locations and numbers of Piping Plovers found in Nova Scotia, 1996.

Site	County	Map sheet	UTM[a] grid	Date	No. of observers	Kms covered	No. of hours	No. of pairs	No. of adult plovers
Bayfield	Antigonish	11F/12	969 546	5 June	1	0.8	0.5	0	0
Captains Pond and Monks Head	Antigonish	11F/12	902 586	5 June	1	3	1.9	1	2
Dunns	Antigonish	11F/12	865 600	5 June	1	2.2	1.42	0	0
Grahams Cove (Ferry Road)	Antigonish	11F/12	945 546	5 June	1	1.4	0.58	0	0
Jimtown	Antigonish	11F/12	858 629	4 June	1	0.45	0.33	0	0
Linwood	Antigonish	11F/12	098 565	7 June	1	3.2	1.25	0	0
Mahoneys	Antigonish	11F/12	860 605	5 June	1	1.7	1.1	2	4
Pomquet	Antigonish	11F/12	940 550	7 June	2	4	3.1	2	6
South Lakevale (Cribbons)	Antigonish	11F/13	847 685	4 June	1	1.8	0.58	0	0
Tracadie Big Island (Delorey)	Antigonish	11F/12	045 553	5 June	1	1.5	0.83	0	0
Tracadie West Arm	Antigonish	11F/12	025 543	5 June	1	0.7	0.25	0	0
Dominion (Lingan)	Cape Breton	11K/1	284 225	3 June	1	?	1.1	0	0
Glace Bay Bar	Cape Breton	11J/4	740 180	3 June	1	?	1.33	0	0
Kennington Cove	Cape Breton	11F/16	284 846	7 June	1	?	2.5	0	0
South (East) Bar	Cape Breton	11K/1	155 205	3 June	1	?	1.5	0	0
Sand Point	Colchester	11E/11	773 647	7 June	2	0.8	2.5	0	0
Cameron	Cumberland	11E/13	435 796	5 June	3	1	1	0	0
Hortons	Cumberland	11E/14	680 736	3 June	2	2.5	0.83	0	0
Long (Cumberland Co.)	Cumberland	11E/14	800 725	3 June	2	2	0.75	0	0
Oak Island	Cumberland	11E/14	685 768	6 June	2	2	2	1	2
Treen Point (Malagash Mines)	Cumberland	11E/14	745 715	3 June	2	1.75	1.4	0	0
West Pugwash	Cumberland	11E/13	444 780	6 June	3	2.5	0.83	0	0
Clam Pond	Guysborough	11F/6	260 306	6 June	2	1.5	0.6	0	0
Ragged Head Pond	Guysborough	11F/6	260 306	6 June	2	1.5	0.6	0	0
Tor Bay	Guysborough	11F/3	295 048	6 June	2	1.1	0.42	0	0
Baltee Island (Romkey's Point)	Halifax	11D/15	255 578	21 June	1	0.25	1	0	0
Clam Harbour	Halifax	11D/10	081 525	3 June	1	1	1	0	0
Conrads (East and West)	Halifax	11D/11	814 496	9 June	2	0.8	1.5	0	0
Conrods, Petpeswick Inlet	Halifax	11D/11	700 434	7 June	11	2	6	1	3
Cow Bay	Halifax	11D/11	651 397	5 June	1	1	0.75	0	0
Fishermans	Halifax	11D/11	822 470	13 June	1	1.8	2	0	0
Lawrencetown	Halifax	11D/11	725 433	8 June	2	1.5	1	0	0
Long (Meisners)	Halifax	11D/11(5)	840 476	10 June	1	1.2	2.5	0	0
Martinique	Halifax	11D/11	900 486	4 June	2	3	6	0	0
Maugher, MacNabs Island	Halifax	11D/12	583 390	6 June	2	2	0.75	0	0
McCormick's, Eastern Passage	Halifax	11D/11	640 374	10 June	2	0.5	0.5	0	0
Rainbow Haven (Cole Harbour)	Halifax	11D/11	659 440	5 June	1	2	0.66	0	0
Sandy Cove and Eastern Sandy Cove	Halifax	11D/15	270 578	21 June	1	0.8	1.5	0	0
Seapool (West Marsh)	Halifax	11D/10	040 524	14 June	1	1.5	2.1	0	0
Stoney (Lawrencetown Head)	Halifax	11D/11	730 433	9 June	1	0.5	1	0	0
Taylor Head Bay	Halifax	11D/15	347 615	3 June	2	1	2.5	0	0
Big Rorys (Emerson) Point	Inverness	11F/13	145 868	6 June	2	0.6	0.5	0	0
Colindale (MacLean's Cove)	Inverness	11K/4	150 020	6 June	2	0.6	0.5	0	0
Little Judique Harbour	Inverness	11F/13	141 905	6 June	2	0.8	0.5	0	0
Port Hood	Inverness	11K/4	137 955	6 June	2	1	0.75	0	0
Bayswater	Lunenburg	21A/9	153 280	5 June	1	1	0.75	0	0
Cape Bay, Cape LaHave Island	Lunenburg	21A/1	900 940	3 June	3	1	0.66	1	2

Table 1. (continued)

Site	County	Map sheet	UTM[a] grid	Date	No. of observers	Kms covered	No. of hours	No. of pairs	No. of adult plovers
Cherry Hill (Conrad)	Lunenburg	21A/2	790 884	5 June	2	2.1	1.2	0	1
Halibut Bay, Cape LaHave	Lunenburg	21A/1	924 927	3 June	3	1	0.66	0	0
Hirtles	Lunenburg	21A/8	985 019	5 June	2	3	0.58	0	0
Kingsburg	Lunenburg	21A/8	996 026	5 June	2	1.4	0.42	0	0
Masons	Lunenburg	21A/8	937 128	5 June	2	1.2	0.33	0	0
Masons Island	Lunenburg	21A/8	997 232	5 June	1	1.4	1	0	0
Rafuse Island	Lunenburg	21A/8	011 229	5 June	1	0.5	1	0	0
Sloop Cove (Moshers Island)	Lunenburg	21A/1	921 987	3 June	3	0.5	0.33	0	0
The Creek, Cape LaHave Island	Lunenburg	21A/1	894 964	3 June	3	2.5	1	0	0
Big Merigomish Island	Pictou	11E/9	480 579	5 June	2	2.75	1.33	0	0
Black Point	Pictou	11E/10	222 674	8 June	1	1.5	0.92	0	0
Bowen Island	Pictou	11E/10	351 556	1 June	2	1	1	1	2
Caribou Island	Pictou	11E/15	225 674	6 June	1	1	0.5	0	0
Chance Harbour	Pictou	11E/9	320 580	9 June	1	0.5	0.25	0	0
James and Little Harbour Spit	Pictou	11E/10	346 568	1 June	2	1	0.5	0	0
Kings Head	Pictou	11E/9	405 546	6 June	1	1.5	0.75	0	0
Melmerby	Pictou	11E/9 (10)	390 555	4 June	2	1.75	0.5	0	0
Pictou Bar Spit (Lighthouse)	Pictou	11E/10	265 587	5 June	2	2	1.25	0	0
Pictou Island, North Shore	Pictou	11E/15	340 743	7 June	2	6	3.2	0	0
Pictou Island, Roger Point	Pictou	11E/15	346 722	7 June	2	0.8	0.5	0	0
Roaring Bull Point	Pictou	11E/10	336 580	8 June	1	0.5	0.46	0	0
Rushtons Park (Murray)	Pictou	11E/14	900 667	11 June	1	1	0.58	0	0
Savage Point, Big Merigomish Island	Pictou	11E/9	425 546	4 June	2	0.5	0.25	0	0
Sinclairs Island	Pictou	11E/10	336 580	8 June	1	0.5	0.46	0	0
Beach Meadows	Queen's	21A/2	687 795	4 June	1	1.2	0.83	1	2
Carters and Wobamkek	Queen's	20P/15	540 629	4 June	1	1.1	0.5	1	2
Cranberry Pond	Queen's	20P/15	555 614	5 June	1	0.6	0.3	0	0
Gull Island	Queen's	20P/15	632 708	5 June	1	0.2	0.28	0	0
Little Port Joli Bay, Kej. NP[b]	Queen's	20P/15	545 580	7 June	1	1.2	1	0	0
Port Joli (Goose Haven)	Queen's	20P/15	490 588	4 June	1	1	0.91	0	0
Port Mouton Island	Queen's	20P/15	569 634	5 June	1	0.4	0.96	0	1
Ragged Harbour	Queen's	21A/2	752 826	4 June	1	0.2	1.16	1	2
Sandy Bay	Queen's	20P/15	480 538	5 June	1	1.2	0.83	1	2
St Catherines River, Kej. NP	Queen's	20P/15	530 560	7 June	1	1.4	1.5	4	8
Summerville	Queen's	20P/15	518 676	4 June	1	1.1	1.75	2	4
Baccaro (Crows Neck)	Shelburne	20P/6	005 165	7 June	2	1.5	0	2	6
Black Point	Shelburne	20P/11	345 405	5 June	1	2.25	0.83	0	0
Bull's Head	Shelburne	20P/11	552 614	7 June	1	2	1.16	1	3
Burk's Point	Shelburne	20P/5	973 168	11 June	1	1.5	1	0	0
Clam Point	Shelburne	20P/5	923 192	7 June	1	1	0.42	0	0
Daniels Head (Southside)	Shelburne	20P/5	905 130	7 June	1	2.5	2	3	6
Fox Bar	Shelburne	20P/11	120 310	5 June	1	2.5	0.33	2	4
Goose (Indian) Point	Shelburne	20P/5	903 190	12 June	1	1	0.75	0	0
Inner (The Cape)	Shelburne	20P/5	865 086	10 June	2	4	1	0	0
Johnstons Pond	Shelburne	20P/15	431 488	5 June	1	0.4	2.4	1	3
Louis Head	Shelburne	20P/14	380 465	5 June	1	2	2	2	5

Table 1. (continued)

Site	County	Map sheet	UTM[a] grid	Date	No. of observers	Kms covered	No. of hours	No. of pairs	No. of adult plovers
Northeast Point	Shelburne	20P/12	900 205	7 June	1	1	0.25	0	0
Red Head	Shelburne	20P/11	104 267	4 June	1	1.5	1.5	0	0
Round Bay and Roseway	Shelburne	20P/11	100 300	4 June	1	1.75	2.4	1	3
Sand Hills Provincial Park (Sebim)	Shelburne	20P/12	934 222	7 June	2	?	2	0	1
Stoney Island	Shelburne	20P/5	925 163	7 June	1	1	0.33	0	0
The Hawk, Cape Sable Isalnd	Shelburne	20P/5	882 096	6 June	1	1.5	1.25	1	2
North Harbour	Victoria	11K/16	935 990	7 June	1	4	2.5	0	0
South Harbour	Victoria	11K/16	955 950	10 June	2	2	1.5	1	3
Totals					158	142.15	116.2	33	79

[a] UTM = Universal Transverse Mercator.

[b] Kejimkujik National Park.

Table 2. Numerical and distributional changes of Piping Plovers in Nova Scotia: results from the 1991 and 1996 International Censuses and the 1994 "mini-census".

		No. of pairs			No. of adults			Percent change (pairs)	Percent change (adults)
Site	**County**	**1991**	**1994**	**1996**	**1991**	**1994**	**1996**	**1991-1996**	**1991-1996**
Bayfield (Bay Field)	Antigonish	0	0	0	0	0	0	0	0
Captains Pond and Monks Head	Antigonish	0	nc[a]	1	0	nc	2	+	+
Dunns	Antigonish	0	nc	0	0	nc	0	0	0
Grahams Cove (Ferry Road)	Antigonish	0	nc	0	0	nc	0	0	0
Jimtown	Antigonish	nc	nc	0	nc	nc	0	–	–
Linwood	Antigonish	nc	nc	0	nc	nc	0	–	–
Mahoney's	Antigonish	0	3	2	0	6	4	+	+
Pomquet	Antigonish	1	2	2	2	4	6	+100	+200
South Lakevale (Cribbons)	Antigonish	nc	nc	0	nc	nc	0	–	–
Tracadie Big Island (Delorey Island)	Antigonish	0	nc	0	0	nc	0	0	0
Tracadie West Arm	Antigonish	0	nc	0	0	nc	0	0	0
Dominion (Lingan)	Cape Breton	1	nc	0	2	nc	0	-100	-100
Glace Bay Bar	Cape Breton	0	1	0	0	2	0	0	0
Kennington Cove	Cape Breton	0	nc	0	0	nc	0	0	0
South East Bar	Cape Breton	nc	nc	0	nc	nc	0	–	–
Sand Point	Colchester	nc	nc	0	nc	nc	0	–	–
Cameron	Cumberland	0	nc	0	0	nc	0	0	0
Hortons	Cumberland	0	nc	0	0	nc	0	0	0
Long (Cumberland Co.)	Cumberland	0	nc	0	0	nc	0	0	0
Oak Island	Cumberland	0	nc	1	0	nc	2	+	+
Treen Point/Malagash Mines	Cumberland	0	nc	0	0	nc	0	0	0
West Pugwash	Cumberland	0	nc	0	0	nc	0	0	0
Clam Pond	Guysborough	0	nc	0	0	nc	0	0	0
Ragged Head Pond	Guysborough	0	nc	0	0	nc	0	0	0
Tor Bay	Guysborough	nc	nc	0	nc	nc	0	–	–
Baltee Island (Romkey's Point)	Halifax	nc	nc	0	nc	nc	0	–	–
Clam Harbour	Halifax	1	0	0	2	0	0	-100	-100
Conrads (East and West)	Halifax	1	2	0	2	4	0	-100	-100
Conrods, Petpeswick Inlet	Halifax	0	nc	1	0	nc	3	+	+
Cow Bay	Halifax	0	nc	0	0	nc	0	0	0
Fishermans	Halifax	0	nc	0	0	nc	0	0	0
Lawrencetown	Halifax	nc	nc	0	nc	nc	0	–	–
Long (Meisners)	Halifax	0	nc	0	0	nc	0	0	0
Martinique	Halifax	1	0	0	2	0	0	-100	-100
Maugher, McNabs Island	Halifax	0	nc	0	0	nc	0	0	0
McCormick's, Eastern Passage	Halifax	nc	nc	0	nc	nc	0	–	–

Table 2. (continued)

		No. of pairs			No. of adults			Percent change (pairs)	Percent change (adults)
Site	**County**	**1991**	**1994**	**1996**	**1991**	**1994**	**1996**	**1991-1996**	**1991-1996**
Rainbow Haven Park (Cole Harbour)	Halifax	1	0	0	3	0	0	-100	-100
Sandy Cove and Eastern Sandy Cove	Halifax	nc	nc	0	nc	nc	0	~	~
Seapool	Halifax	0	nc	0	0	nc	0	0	0
Stoney (Lawrencetown Head)	Halifax	1	0	0	2	0	0	-100	-100
Taylor Head	Halifax	0	nc	0	0	nc	0	0	0
Big Rorys (Emerson) Point	Inverness	0	nc	0	0	nc	0	0	0
Colindale	Inverness	0	nc	0	0	nc	0	0	0
Little Judique Harbour	Inverness	0	nc	0	0	nc	0	0	0
Port Hood	Inverness	0	nc	0	0	nc	0	0	0
Bayswater	Lunenburg	0	nc	0	0	nc	0	0	0
Cape Bay, Cape LaHave Island	Lunenburg	2	0	1	4	0	2	-50	-50
Cherry Hill (Conrad)	Lunenburg	3	2	0	6	4	1	-100	-83.3
Halibut Bay	Lunenburg	0	nc	0	0	nc	0	0	0
Hirtles	Lunenburg	0	nc	0	0	nc	0	0	0
Kingsburg	Lunenburg	0	0	0	0	1	0	0	0
Masons	Lunenburg	0	nc	0	0	nc	0	0	0
Masons Island	Lunenburg	0	nc	0	0	nc	0	0	0
Rafuse Island	Lunenburg	0	nc	0	0	nc	0	0	0
Sloop Cove (Moshers Island)	Lunenburg	0	nc	0	0	nc	0	0	0
The Creek, Cape LaHave Island	Lunenburg	0	0	0	0	0	0	0	0
Big Merigomish Island	Pictou	0	0	0	0	0	0	0	0
Black Point	Pictou	nc	nc	0	nc	nc	0	~	~
Bowen Island	Pictou	2	2	1	4	4	2	-50	-50
Caribou Island	Pictou	0	nc	0	0	nc	0	0	0
Chance Harbour	Pictou	nc	nc	0	nc	nc	0	~	~
James and Little Harbour Spit	Pictou	0	nc	0	1	nc	0	0	-100
Kings Head	Pictou	0	nc	0	0	nc	0	0	0
Melmerby	Pictou	0	0	0	0	0	0	0	0
Pictou Bar Spit (Lighthouse)	Pictou	1	nc	0	2	nc	0	-100	-100
Pictou Island, North Shore	Pictou	nc	nc	0	nc	nc	0	~	~
Pictou Island, Roger Point	Pictou	nc	nc	0	nc	nc	0	~	~
Roaring Bull Point	Pictou	0	nc	0	0	nc	0	0	0
Rushtons Park (Murray)	Pictou	0	nc	0	0	nc	0	0	0
Savage Point, Big Merigomish Island	Pictou	0	nc	0	0	nc	0	0	0
Sinclairs Island	Pictou	0	nc	0	0	nc	0	0	0
Beach Meadows	Queens	2	2	1	4	4	2	-50	-50
Carters and Wobamkek	Queens	2	1	1	4	2	2	-50	-50
Cranberry Pond	Queens	1	nc	0	2	nc	0	-100	-100
Gull Island	Queens	0	nc	0	0	nc	0	0	0
Little Port Joli Bay, Kej. NP[b]	Queens	1	nc	0	2	nc	0	-100	-100
Port Joli (Goose Haven)	Queens	2	0	0	4	0	0	-100	-100
Port Mouton Island	Queens	0	nc	0	0	nc	1	0	+

Table 2. (continued)

Site	County	No. of pairs			No. of adults			Percent change (pairs)	Percent change (adults)
		1991	1994	1996	1991	1994	1996	1991-1996	1991-1996
Ragged Harbour	Queens	nc	1	1	nc	2	2	–	–
Sandy Bay	Queens	1	nc	1	2	nc	2	0	0
St Catherines River, Kej. NP	Queens	3	4	4	8	8	8	+33.3	0
Summerville	Queens	3	3	2	7	6	4	-33.3	-42.9
Baccaro (Crows Neck)	Shelburne	3	4	2	6	9	6	-33.3	0
Blanche Point	Shelburne	0	nc	nc	0	nc	nc	–	–
Black Point (Mathews Lake)	Shelburne	1	nc	0	3	nc	0	-100	-100
Bull's Head	Shelburne	nc	nc	1	nc	nc	3	–	–
Burks Point (Powells)	Shelburne	1	nc	0	2	nc	0	-100	-100
Clam Point	Shelburne	1	nc	0	2	nc	0	-100	-100
Daniels Head (Southside)	Shelburne	3	nc	3	7	nc	6	0	-14.3
Fox Bar	Shelburne	2	0	2	4	2	4	0	0
Goose (Indian) Point	Shelburne	1	nc	0	2	nc	0	-100	-100
Inner (The Cape)	Shelburne	1	nc	0	2	nc	0	-100	-100
Johnstons Pond	Shelburne	1	1	1	2	2	3	0	+50
Louis Head	Shelburne	2	1	2	4	2	5	0	+25
Northeast Point	Shelburne	1	nc	0	2	nc	0	-100	-100
Red Head	Shelburne	1	nc	0	2	nc	0	-100	-100
Round Bay and Roseway	Shelburne	3	2	1	6	6	3	-66.7	-50
Sand Hills Provincial Park (Sebim)	Shelburne	1	1	0	3	3	1	-100	-66.7
Stoney Island	Shelburne	0	1	0	0	2	0	0	0
The Hawk	Shelburne	0	3	1	1	7	2	+	+100
North Harbour	Victoria	0	nc	0	0	nc	0	0	0
South Harbour	Victoria	0	nc	1	0	nc	3	+	+
Totals		52	36	33	113	80	79	-36.5	-30.1

[a] nc - not censused.

[b] Kejimkujik National Park.

Table 3. Fledging success of Piping Plovers in Nova Scotia,1996.

Site	County	No. of pairs year-end	No. of pairs monitored	Nesting attempts	Successful nests	No. fledged	Productivity
Captains Pond and Monks Head	Antigonish	1	0				
Mahoneys	Antigonish	2	2	2	?	?	
Pomquet	Antigonish	2	2	2	2	8	4.00
Oak Island	Cumberland	1	0				
Conrods, Petpeswick Inlet	Halifax	1	1	1	?	?	
Cape Bay, Cape LaHave Island	Lunenburg	1	0				
Bowen Island	Pictou	1	0				
Beach Meadows	Queens	1	1	1	1	4	4.00
Carters and Wobamkek	Queens	1	0				
Ragged Harbour	Queens	1	1	1	1	4	4.00
Sandy Bay	Queens	1	1	1	1	2	2.00
St Catherines River, Kej. NP[a]	Queens	8	8	11	5	13	1.63
Summerville	Queens	2	2	2	2	6	3.00
Baccaro (Crows Neck)	Shelburne	2	2	2	?	?	
Bull's Head	Shelburne	1	1	1	?	?	
Daniels Head (Southside)	Shelburne	3	2	2	?	?	
Fox Bar	Shelburne	2	0				
Johnstons Pond	Shelburne	1	1	1	?	?	
Louis Head	Shelburne	2	1	1	?	?	
Round Bay and Roseway	Shelburne	1	0				
The Hawk	Shelburne	1	0				
South Harbour	Victoria	1	0				
Totals		37	25	28+	12+	37+	

[a] Kejimkujik National Park.

2.3 The 1996 Piping Plover census in Prince Edward Island

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Abstract

The Prince Edward Island component of the 1996 International Piping Plover Census was conducted on 1-7 June, using 57 trained volunteers. Seventy-seven beaches (180.25 km) with suitable habitat were censused. Piping Plovers were found on five beaches inside Prince Edward Island National Park and 14 beaches outside the national park. These 14 unprotected beaches now support more than half of the island's population.

The International Piping Plover Census carried out in 1991 resulted in 110 Piping Plovers being counted on Prince Edward Island. In 1994, a partial census located 60 birds. In 1996, 65 birds were found. Large decreases in plover numbers between the 1991 census and the 1996 census were noted on Greenwich Point, Conway Sand Hills, Hog Island, North Rustico Sandbar, Cavendish Sandspit, Covehead Harbour and Blooming Point. Disturbance was noted on many beaches, and vehicular traffic in western Prince County was particularly heavy. Important conservation advances and/or activities in the past five years include extensive protection methods inside Prince Edward Island National Park and more limited efforts on nesting beaches outside the Park boundaries.

Résumé

À l'Île-du-Prince-Édouard, les travaux du Recensement international des Pluviers siffleurs de 1996 se sont déroulés du 1er au 7 juin. Cinquante-sept bénévoles formés ont parcouru 77 plages (d'une longueur totale de 180,25 km) renfermant l'habitat de l'espèce. Des pluviers ont été dénombrés sur 19 plages, dont 5 à l'intérieur du parc national de l'Île-du-Prince-Édouard. Les 14 plages non protégées situées à l'extérieur du parc accueillent actuellement plus de la moitié de la population de l'île.

Les dénombrements effectués en 1991 dans le cadre du recensement international ont permis d'observer 110 individus dans l'Île-du-Prince-Édouard. En 1994, on y a dénombré 60 individus à l'occasion d'un recensement partiel, tandis qu'en 1996, l'effectif enregistré s'élevait à 65 oiseaux. On a observé d'importantes baisses des effectifs entre 1991 et 1996 aux endroits suivants : pointe Greenwich, Conway Sand Hills, île Hog, North Rustico Sandbar, Cavendish Sandspit, Covehead Harbour et pointe Blooming. Les recenseurs ont noté que les oiseaux subissaient des perturbations sur de nombreuses plages et que la circulation était particulièrement intense dans l'ouest du comté de Prince. D'importants progrès ont été réalisés en matière de conservation au cours des cinq dernières années, notamment l'emploi de méthodes de protection élaborées à l'intérieur du parc national et l'exécution de mesures plus limitées sur les plages de nidification situées à l'extérieur du parc.

Introduction

The Committee on the Status of Endangered Wildlife in Canada designated the Piping Plover *Charadrius melodus* as threatened in 1978 and endangered in 1985 because of information indicating that the population was in decline. In response to the endangered designation, a Canadian Piping Plover Recovery Plan was developed (Atlantic and the Prairie Piping Plover Recovery Teams 1989). Among other conservation measures, this plan calls for a census of the population every five years.

Censuses of Piping Plovers on Prince Edward Island have been conducted since 1977 (Cairns 1978; Johnson and Feldstein 1983; MacLeod 1984; Northcott and Creamer 1987; Flemming 1992), however, most of these censuses counted only a small portion of the provincial population in a given year. Important census and productivity data have been collected in Prince Edward Island National Park (PEINP) since 1977 (Corbett 1988; Flemming 1992).

The first International Piping Plover Census in 1991 provided an opportunity to fill informational gaps on the distribution and status of the species in Prince Edward Island. In 1991, 110 adults were found, comprising 51 pairs and eight single birds on 20 beaches. At that time, since Edward Island's beaches provided habitat for over 20% of the Eastern Canada population, and over 5% of the Canadian population. The provincial population appeared relatively stable based on previous population estimates and mean productivity (McAskill et al. 1994).

In 1994, in response to a request by the U.S. Fish and Wildlife Service, a "mini-census" was conducted on the 24 beaches that had previously supported plovers, plus five beaches that had prime habitat or reports of nesting plovers since 1991. At that time, 60 birds were found (26 pairs, eight singles), comprising about 15% of the Eastern Canada population.

This paper summarizes the results of the International Piping Plover Census on Prince Edward Island for 1996 and outlines the conservation efforts in the province during the last five years.

Methods

Several calls for volunteers to assist with the census were made from January to April 1996 in newsletters and press releases. A letter of invitation was also sent to known birders and others interested in Piping Plover conservation on Prince Edward Island.

Educational sessions were held on 30 March and 15 May to train volunteers in the census techniques, finalize beach assignments and distribute census kits. Beach census kits included instructions, an identification sheet on plover and predator tracks, a 1:50 000 topographical map (photocopy), an Piping Plover census form and a pin for identification purposes. Wherever possible, volunteers with previous census experience were paired with those with little or no experience. In all cases, organizers were confident with the ability of each team of volunteers to identify, locate and correctly count plovers. Volunteers censused beaches with plover habitat outside PEINP. Parks Canada staff censused all beaches inside the Park's boundaries.

Beaches to be censused were generally the same sites surveyed during 1991, however there were some exceptions and additions. Eighteen new beaches were censused in 1996. These additional sites were largely small sand coves, considered non-traditional habitat, that had supported birds in the past four years or were similar to sites that had plovers. Three beaches surveyed in 1991 were determined to be unsuitable for plover nesting and were not censused in 1996.

During the 1991 census, the entire shore line (inner and outer) of Cascumpec Sand Hills, Conway Sand Hills and Hog Island was censused on foot. However, in 1996, volunteers were instructed to census on foot only the ends of the islands and wash over areas, as beaches elsewhere on these barrier islands are narrow and have little suitable habitat for plovers. While travelling along the outer coast of these sand hills in a motor boat, six observers watched the shoreline from 50 - 100 m for suitable habitat. When such an area was spotted, observers were brought within 10 m of shore to scan for plovers. Only the distances censused on foot are reported in Table 1.

Censuses on most beaches were carried out by two people, one walking along the shoreline and the other walking close to the dunes. When a Piping Plover was spotted, the person near the dunes moved to join the second person near the water. Plovers were counted and the observers proceeded 100 m past the plover, before returning to the original formation. Special attention was paid to washover areas, the ends of sandspits, islands and to beaches with Piping Plover tracks. During the census, volunteers were asked to record the presence of people or vehicles on the beach and the tracks of people, dogs, predators and vehicles.

Results

The 1996 International Piping Plover Census was completed in Prince Edward Island from 1-7 June. Sixty-five beaches were surveyed from 1-3 June and 12 were surveyed from 4-7 June (Table 1; Fig. 1). Sixty-five adult Piping Plovers were counted on 19 of the 77 beaches surveyed throughout the province (Fig. 1). These consisted of 29 pairs and seven single adults.

Several areas were identified as being particularly important for Piping Plovers. These included the Conway Sand Hills/Hog Island Chain (six adults), the Cabot Provincial Park to Cousins Pond shoreline (nine adults), Canavoy Beach (nine adults) and PEINP (29 adults). A total of 36 adults were found outside PEINP (Table 1).

In 1996, Piping Plovers were found on three beaches not censused in 1991: Tryon River (one adult), Campbell's Pond (two adults), and North Rustico Sandbar (four adults). A late report of a pair of plovers at East Point (not censused during census period) is not included in the census results.

Considerable decreases in numbers of plovers were observed on the majority of beaches. Six censused beaches with one or more plovers in 1991 had no birds in 1996, while nine beaches which had plovers during both censuses had fewer plovers in 1996. Four beaches had no change in the number of plovers and only one beach with plovers in 1991 had a larger number of birds in 1996. However, two censused beaches (East Lake and Rustico Island Sandspit) with no plovers in 1991 had one or more plovers in 1996 (Table 2).

Strong winds combined with high tides may have destroyed plover nests and altered habitat of many of the nesting sites during the census period. However, censusers reported sunny conditions with winds of 0-40 km/hour and temperatures of 18-22°C during their actual census time periods. Disturbance by vehicles was very high on most west Prince County beaches such as Black Pond West, Foleys Pond, Jacques Cartier Spit, Kildare Capes, Little Miminegash Pond, Miminegash Pond, Nail Pond, Round Pond and Tignish Shore. Eastern beaches with vehicular disturbance included East Lake, Panmure Island and South Lake.

Discussion

The 1996 International Piping Plover Census revealed an estimated population of 65 adult Piping Plovers (29 pairs and seven singles) in the province during the census period. A comparison of the 1996 census with the 1991 census (110 adults) indicates a severe population decline (41%) over the past five years. Provincial beaches now provide habitat for 15% of Piping Plovers in Eastern Canada whereas in 1991 they supported 20% of the regional population.

Many areas showed large decreases in plover numbers from 1991 to 1996. PEINP reported 14 pairs and one single bird during the 1996 census while 23 pairs and no single birds were counted in 1991. Blooming Point, a beach within the Park, reported eight pairs (16 adults) in 1991, whereas in 1996 only one adult was recorded. There is speculation that the observed decline at this site is due to change or loss of habitat or a significant increase in depredation over the past two years (L. Thomas, pers. comm.).

All plovers found on the Hog Island Sand Hill chain (Cascumpec, Conway, Hog Island) were found at the ends of these barrier islands or in one large wash-over area. These areas had ideal plover habitat yet there were only six adults in 1996, compared to a total of 19 adults in the area in 1991. There is no explanation for such a decline, since there is an abundance of good habitat and little human disturbance.

A number of other beaches that appeared to have suitable nesting habitat and low amounts of disturbance (e.g., Boughton Bay) were found to have no Piping Plovers and others with high levels of human disturbance had nesting pairs (e.g., Jacques Cartier, Cabot Provincial Park, Darnley Point). Based on the large number of vehicle tracks on west Prince County beaches during the census, there is a need for increased enforcement by Prince Edward Island Department of Environmental Resources officers and cooperation from Federal Fisheries officers in the area.

Of the 18 beaches added to the 1991 International Piping Plover Census, three, Tryon River (one adult), Campbell's Pond (two adults) and North Rustico Sandbar (four adults) supported Piping Plovers in 1996. The plover at Tryon River was a single foraging bird. The area had little or no cobble and was unsuitable as nesting habitat but this sandspit has lengthened by accretion, creating a good foraging area. North Rustico Sandbar formed in the late 1960's as the sandspit on Rustico Island eroded eastward. This new census area was relatively productive, supporting two pairs. Campbell's Pond is a good example of the small sandy coves that appear to be attractive to nesting pairs. Thought to be too small for nesting Piping Plovers in the past, 12 of the 18 new sites fit into this 'non-traditional' site category. A late report of a nesting pair with four eggs in mid July at East Point, a site not previously censused, is a good example of this type of area. This site should be included in the next census.

Conservation and management inside PEINP is intensive, with hired monitors, beach closures, the use of nest predator exclosures, egg rescue and incubation, and public education and awareness. This has been continuous over the last five years. Productivity is well monitored and was reported to be two fledged chicks per pair for 1996.

Outside the Park, a volunteer guardian program has been in place since 1993. Volunteers have provided sporadic monitoring of plover beaches. Cousins Pond has been monitored by volunteers extensively while all others had very little management other than signage at the nest territory boundary. In 1996, all nesting beaches except offshore islands had signs placed to create a symbolic barrier at the nest territory boundaries. These eight beaches had good to nil volunteer visits during the breeding season.

During the census period and while placing signs on plover nesting beaches after the census, organizers and volunteers found pairs had moved from one beach to another, renested, or had not yet settled in several instances. PEINP reported birds nesting later in 1996 than other years (L. Thomas, pers. comm.). This, coupled with the late discovery of a nesting pair at East Point, indicates that the 1996 estimate of the plover population may be low. However, the late birds observed also may be a result of disturbance on nearby beaches, with plovers moving to alternate sites to avoid stresses.

The Piping Plover conservation programs in PEINP as well as guardian programs outside the Park are crucial to the survival of the Piping Plover in the province. Good coastal stewardship can protect habitat with little human disturbance while providing for complementary human recreational activities and ensuring a future for this species.

Acknowledgements

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Figure 1. Location of sites censused on Prince Edward Island during the 1996 International Piping Plover Census.

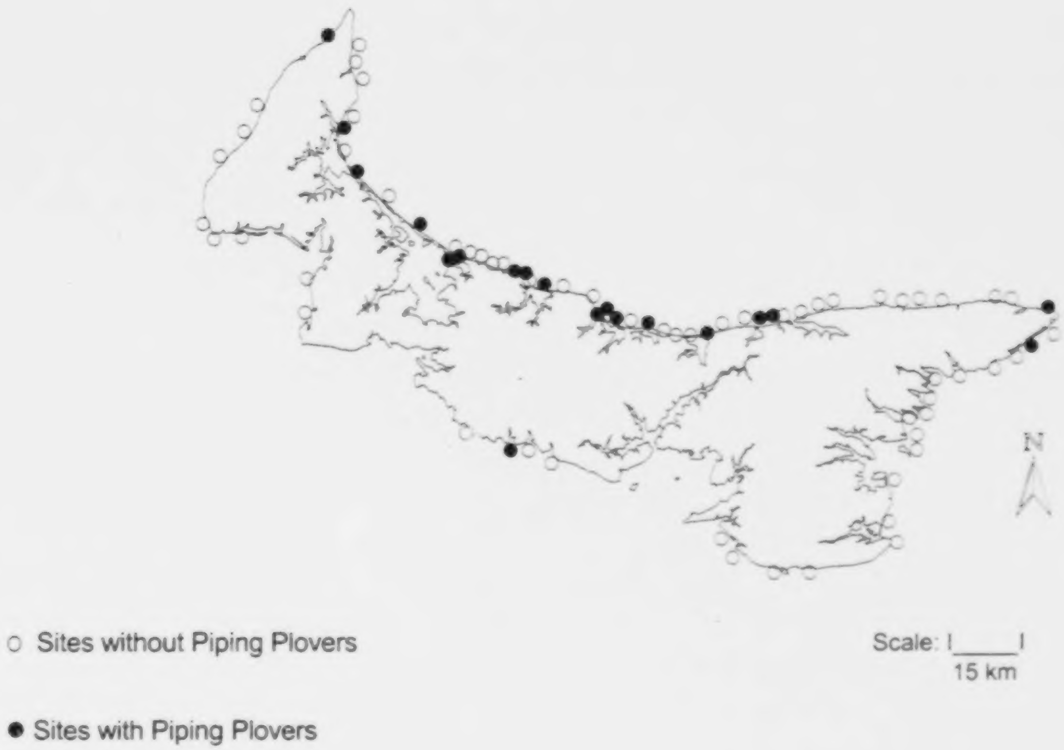
N
○ Sites without Piping Plovers
● Sites with Piping Plovers
Scale: I_____I
15 km

Table 1. 1996 International Piping Plover Census for Prince Edward Island.

Site[a]	Date	Map sheet	UTM[b]	Distance covered (km)	No. observers	No. adults	Pairs
Kings County							
Basin Head	3 June	11L/8	570000 4137400	3.2	2	0	0
Beach Point	1 June	11L/1	540500 5096300	1.0	2	0	0
Black Pond	1 June	11L/8	564300 5134800	2.0	2	0	0
Boughton Bay	1 June	11L/1	544500 5121500	1.5	2	0	0
Boughton Island	7 June	11L/1	544900 5116400	2.0	2	0	0
Cable Head	1 June	11L/8	533000 5145900	2.2	2	0	0
Canavoy	2 June	11L/7	513500 5142000	4.0	2	9	4
Cross River	1 June	11L/8	556500 5146900	0.5	2	0	0
Diligent Pond	1 June	11L/8	577900 5143600	1.0	2	0	0
East Lake	2 June	11L/8	576200 5145800	2.0	2	1	0
Eglington Cove	1 June	11L/8	550000 5129800	2.1	2	0	0
Greenwich Point	1 June	11L/7	522000 5144000	6.2	2	0	0
Howe Bay	1 June	11L/8	548200 5127000	2.0	3	0	0
Lake Run	2 June	11L/7	517100 5142800	2.0	1	2	1
Launching Point	1 June	22L/1	545600 5117700	2.0	2	0	0
McAskill River	1 June	11L/7	535400 5145900	0.5	2	0	0
Naufrage	1 June	11L/8	544700 5146000	2.0	2	0	0
North Lake	2 June	11L/8	572100 5146400	1.7	2	0	0
Panmure Island	1 June	11L/1	541100 5108500	5.8	2	0	0
Poverty Beach	1 June	11L/1	540200 5080500	6.8	2	0	0
Priest Pond	1 June	11L/8	562800 5147700	1.5	2	0	0
Savage Harbour West	1 June	11L/7	512000 5142000	1.0	2	0	0
Schooner Pond	1 June	11L/7	525500 5144800	2.0	2	0	0
Souris Causeway	1 June	11L/8	556100 5133600	1.0	2	0	0

Table 1. (continued)

Site[a]	Date	Map sheet	UTM[b]	Distance covered (km)	No. observers	No. adults	Pairs
South Lake	3 June	11L/8	574500 5140700	4.9	2	1	0
Spry Cove	1 June	11L/8	548000 5124000	1.0	3	0	0
St. Margarets	1 June	11L/8	547500 5146000	0.5	2	0	0
St. Peters Harbour	2 June	11L/7	519500 5143200	3.0	1	0	0
Prince County							
Barachois Run	5 June	21I/9	415300 5153500	4.8	1	0	0
Black Pond West	7 June	21I/16	409200 5197000	0.4	2	0	0
Cabot Provincial Park	4 June	11L/12	446500 5156000	2.2	2	3	1
Cape Traverse	2 June	11L/4	449800 5119500	0.9	2	0	0
Cascumpec Sand Hills	2 June	21I/16	421800 5180500	1.0	3	0	0
Cedar Dunes Park	4 June	21I/9	394100 5163100	2.0	2	0	0
Cedar Dunes West	4 June	21I/9	393200 5165000	0.5	2	0	0
Conway Sand Hills	2 June	11L/12	428500 5171800	2.0	2	2	1
Darnley Point	1 June	11L/12	447800 5153500	1.3	2	2	1
Foley's Pond	2 June	21I/16	423100 5189400	1.0	3	0	0
Hog Island	2 June	11L/12	439600 5162000	3.0	3	4	2
Indian Point Sandspit	6 June	21I/9	402000 5164100	7.0	4	0	0
Jacques Cartier East	2 June	21I/16	421400 5185500	6.4	2	2	1
Kildare Capes	2 June	21I/16	425500 5193200	2.0	3	0	0
Little Miminegash	7 June	21I/16	403500 5186700	1.5	2	0	0
Maximville	5 June	21I/8	413700 5143800	2.0	1	0	0
Miminegash	7 June	21I/16	405900 5192400	0.9	2	0	0
Morrison's Pond	1 June	11L/12	451200 5156400	2.0	2	0	0
Nail Pond	7 June	21P/13 11M/4	420000 5205500	2.6	2	1	0
Profitt's Point	1 June	11L/12	449500 5156800	2.0	2	0	0

Table 1. (continued)

Site[a]	Date	Map sheet	UTM[b]	Distance covered (km)	No. observers	No. adults	Pairs
Round Pond	2 June	21I/16	425200 5196500	1.5	3	0	0
Tignish Shore	2 June	21I/16	424500 5198300	2.0	3	0	0
Tryon River	2 June	11L/4	458100 5117600	0.2	2	1	0
Queens County							
Adams Pond	1 June	11L/12	453600 5155500	0.5	2	0	0
Bell Point	1 June	11E/15	510600 5092200	2.0	2	0	0
Blooming Point	1 June	11L/6	499400 5141000	14.5	2	1	0
Brackley Main	1 June	11L/6	487100 5142700	0.2	2	0	0
Branders Pond	1 June	11L/12	455200 5154900	1.0	2	0	0
Campbell's Pond	1 June	11L/12	458000 5153800	.75	2	2	1
Cavendish Sandspit	1 June	11L/6	469100 5149600	10.0	1	10	5
Cavendish Camp Ground Beach	1 June	11L/6	466100 5150000	2.0	1	0	0
Cousins Pond	1 June	11L/12	457000 5154200	1.5	2	2	1
Covehead Harbour	1 June	11L/6	487100 5142700	4.8	1	10	5
DeRoche Pond	1 June	11L/7	505000 5141000	3.0	2	0	0
Gascoigne Cove East	1 June	11L/2	508600 5094500	1.5	2	0	0
Gascoigne Cove West	1 June	11L/2	508000 5095500	1.8	2	0	0
Hampton	2 June	11L/3	467100 5116500	1.0	2	0	0
North Rustico Beach	1 June	11L/6	477600 5144500	1.0	1	0	0
North Rustico Sandbar	1 June	11L/6	477400 5143800	2.0	2	4	2
Rustico Island Sandspit	1 June	11L/6	479100 5143600	3.5	1	2	1
Rustico Island Causeway	1 June	11L/6	482100 5142300	2.0	1	6	3
Tracadie Beach to Covehead Habour East	1 June	11L/6	493000 5141300	8.0	1	0	0
Tracadie Sandbar[c]	1 June	11L/6	496800 5140800	1.0	1	0	0

Table 1. (continued)

Site[a]	Date	Map sheet	UTM[b]	Distance covered (km)	No. observers	No. adults	Pairs
Victoria	2 June	11L/3	463000 5117400	0.8	2	0	0
Wood Islands	1 June	11E/15	518500 5089500	2.3	2	0	0
Yankee Beach	1 June	11L/12	450500 5162600	0.5	2	0	0
Totals	77 Beaches Censused			180.25 km		65	29

[a] 100% of habitat covered on all sites.

[b] UTM = Universal Transverse Mercator.

[c] Tracadie Sandbar has been separated from Tracadie Beach as reported in 1991as it is outside Prince Edward Island National Park. This is not a new census area.

Table 2. Locations and numbers of Piping Plover in Prince Edward Island, 1991 vs. 1996 International Piping Plover Census.

Site[a]	Piping Plovers (1991)			Piping Plovers (1996)			% Change
	Adults	Pairs	Singles	Adults	Pairs	Singles	
DeRoche Pond	0	0	0	0	0	0	
Savage Harbour West	2	1	0	0	0	0	-100
Canavoy	11	5	1	9	4	1	-18
Lake Run	2	1	0	2	1	0	0
St.Peters Harbour	0	0	0	0	0	0	
Greenwich Point	6	3	0	0	0	0	-100
Schooner Pond	NC[b]	NC	NC	0	0	0	
Cable Head	0	0	0	0	0	0	
McAskill River	NC	NC	NC	0	0	0	
Cow River	0	0	0	NC	NC	NC	
Naufrage	2	1	0	0	0	0	-100
St. Margarets	NC	NC	NC	0	0	0	
Cross River	0	0	0	0	0	0	
Priest Pond	0	0	0	0	0	0	
North Lake	0	0	0	0	0	0	
East Lake	0	0	0	1	0	1	+[c]
Diligent Pond	1	0	1	0	0	0	-100
South Lake	2	1	0	1	0	1	-50
Basin Head	0	0	0	0	0	0	
Black Pond	NC	NC	NC	0	0	0	
Souris Causeway	0	0	0	0	0	0	
Eglington Cove	2	1	0	0	0	0	-100
Howe Bay	2	1	0	0	0	0	-100
Spry Cove	0	0	0	0	0	0	
Boughton Bay	0	0	0	0	0	0	
Launching Point	0	0	0	0	0	0	
Boughton Island	0	0	0	0	0	0	
Panmure Island	0	0	0	0	0	0	
Poverty Beach	0	0	0	0	0	0	
Beach Point	0	0	0	0	0	0	
Wood Islands	0	0	0	0	0	0	
Bell Point	0	0	0	0	0	0	
Gascoigne Cove East	0	0	0	0	0	0	
Gascoigne Cove West	0	0	0	0	0	0	
Pond Point	0	0	0	NC	NC	NC	
Hampton	0	0	0	0	0	0	
Victoria	0	0	0	0	0	0	
Tryon River	NC	NC	NC	1	0	1	
Cape Traverse	0	0	0	0	0	0	
Maximville	NC	NC	NC	0	0	0	
Barachois Run	0	0	0	0	0	0	
Indian Pt. Sand Hills	0	0	0	0	0	0	
Cedar Dunes West	0	0	0	0	0	0	
Cedar Dunes Park	0	0	0	0	0	0	
Little Minimegash Pond	NC	NC	NC	0	0	0	

Table 2. (continued)

Site[a]	Piping Plovers (1991)			Piping Plovers (1996)			% Change
	Adults	Pairs	Singles	Adults	Pairs	Singles	
Minimegash Pond	0	0	0	0	0	0	
Black Pond West	NC	NC	NC	0	0	0	
Nail Pond	1	0	1	1	0	1	0
Tignish Shore	0	0	0	0	0	0	
Kildare Capes	0	0	0	0	0	0	
Round Pond	NC	NC	NC	0	0	0	
Foley's Pond	NC	NC	NC	0	0	0	
Jacques Cartier Spit East	5	2	1	2	1	0	-60
Cascumpec Sand Hills	0	0	0	0	0	0	
Conway Sand Hills	8	3	2	2	1	0	-75
Rocky Point	0	0	0	NC	NC	NC	
Hog Island	11	5	1	4	2	0	-64
Cabot Provincial Park	4	2	0	3	1	1	-25
Darnley Point	3	1	1	2	1	0	-33
Profitt's Point	NC	NC	NC	0	0	0	
Morrisson's Pond	NC	NC	NC	0	0	0	
Adam's Pond	NC	NC	NC	0	0	0	
Brander's Pond	NC	NC	NC	0	0	0	
Cousins Pond	2	1	0	2	1	0	0
Campbell's Pond	NC	NC	NC	2	1	0	
Yankee Beach	NC	NC	NC	0	0	0	
Cavendish Sandspit [d]	20	10	0	10	5	0	-50
Cavendish Campground [d]	NC	NC	NC	0	0	0	
North Rustico Beach [d]	0	0	0	0	0	0	
Rustico Island Sandspit [d]	0	0	0	2	1	0	+
North Rustico Sandbar	NC	NC	NC	4	2	0	
Rustico Island Causeway [d]	6	3	0	6	3	0	0
Covehead Harbour [d]	4	2	0	10	5	0	+150
Brackley Main [d]	0	0	0	0	0	0	
Tracadie Beach [d, e]	0	0	0	0	0	0	
Tracadie Sandbar	0	0	0	0	0	0	
Blooming Point [d]	16	8	0	1	0	1	-94
Totals	110	51	8	65	29	7	41% decline

[a] Beaches in Table 2 are listed in order as they occur geographically; travelling east from DeRoche Pond along the north shore to East Point, west along the south shore to Nail Pond, east along the north shore to Blooming Point.

[b] NC = Not censused.

[c] + with no number = adult(s) present in 1996 but not in 1991.

[d] Prince Edward Island National Park beaches.

[e] Tracadie Sandbar has been separated from Tracadie Beach as reported in 1991 as it is outside Prince Edward Island National Park. This is not a new census area.

2.4 The 1996 Piping Plover census in New Brunswick

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Abstract

During the 1996 International Piping Plover Census, 146 adult Piping Plovers (*Charadrius melodus)* including 65 pairs and 16 singles, were counted at 26 sites in New Brunswick. A total of 47 beaches were censused from 3-18 June 1996. The Acadian Peninsula of northeastern New Brunswick (75%) and Kouchibouguac National Park (15%) continue to support the bulk (90%) of the provincial population.

The New Brunswick population was estimated at 203 adult plovers during the first International Piping Plover Census of 1991. The 1996 census results indicate a decrease in numbers of adult plovers by approximately 28% since 1991, despite indications of good production in recent years. Factors thought to have contributed to the decrease in the provincial population include continued human disturbance in many nesting areas and in a few specific sites, natural habitat changes.

Résumé

Lors du Recensement international des Pluviers siffleurs *Charadrius melodus* de 1996, on a dénombré 146 adultes (65 couples et 16 individus) à 26 sites au Nouveau-Brunswick. Les recenseurs ont visité 47 plages du 3 au 18 juin. Encore une fois, la grande majorité (90%) de la population néo-brunswickoise de l'espèce nichait dans la péninsule acadienne (nord-est de la province) (75%) et le parc national Kouchibouguac (15%).

Les effectifs de Pluviers siffleurs au Nouveau-Brunswick ont été estimés à 203 adultes lors du premier recensement international, en 1991. Les résultats obtenus en 1996 révèlent une baisse d'environ 28% du nombre d'adultes, malgré les indications d'une bonne production ces dernières années. On estime que la diminution des effectifs dans cette province est attribuable au fait que nombre d'aires de nidification subissent encore des perturbations humaines et aux changements de l'habitat naturel en quelques endroits bien précis.

Introduction

New Brunswick beaches provide important habitat for Piping Plovers. Habitats in several areas have been censused regularly for well over 10 years now, including northeastern New Brunswick since 1986 and Kouchibouguac National Park (KNP) since 1982. The first comprehensive census of all beaches is, however, fairly recent. The 1991 International Piping Plover Census provided the first opportunity to assess the provincial population as a whole, and determine its significance to the regional population. During 1991, it was estimated that nearly 40% of the Eastern Canada population was found within the province.

A mini-census conducted in 1994 suggested that the provincial population was declining. The 1994 mini-census counts however were not anticipated to be completely reliable since not all sites were surveyed and a redistribution could have occurred since 1991. This current paper summarizes the results of the 1996 New Brunswick provincial census and encompasses the majority of known and potential Piping Plover habitats. Important conservation activities since 1991 are also described.

Methods

An inventory of beach habitats to be censused was compiled on the basis of the 1991 International Piping Plover Census list of sites with some additions and deletions according to new information. The original 1991 list was prepared by using past census data, approaching local naturalists, and assessment of aerial photos with follow-up site inspections (Chiasson et al. 1994). Sites where habitat was not considered suitable when censused in 1991 or were determined to be unsuitable were removed from the list. One site was not surveyed because it was considered unsuitable for nesting. Sites where plovers have been discovered since 1991 were added to the list. A total of 49 areas of suitable habitat were identified (Fig. 1). Two sites were not censused because boats were unavailable to access them.

Volunteers were chosen by contacting persons who had participated in the 1991 census, and filling gaps through various contacts. Each volunteer was provided with a package containing: 1) information and guidelines from the International Piping Plover Census coordinator (J. Plissner); 2) a blank census report data sheet for each assigned beach, modified for the province of New Brunswick; 3) a map indicating coverage from the 1991 census and 4) blank map sheets for indicating area covered in 1996. A cover letter describing the two-person census technique was also included. The two-person technique was similar to the methodology used in 1991 and is described in detail elsewhere (Chiasson et al. 1994). Fledging success was measured for pairs that laid eggs and whose young were monitored for at least 21 days.

Results

In total, 47 beaches were surveyed from 3-18 June (Table 1). Nine beaches were censused after 9 June, outside the official census window. Thirty-eight volunteers were required to complete the census, which encompassed 213.45 km of coastal habitat during at least 99.8 hours of census time. The census estimated the New Brunswick population at 146 adults, including 65 pairs and 16 single birds or approximately 34% of the Eastern Canada population (Table 2).

Piping Plovers were counted at 26 of the censused sites. Five of these sites provided habitat for 10 or more birds. These important sites are KNP(22 plovers), Pointe à Bouleau (14 plovers), Ward Road North (Grande Plaine) (12 plovers), Tracadie Dune (Tracadie Sandspit) (12 plovers) and Tabusintac Spit (12 plovers). These areas encompass almost 50% of the provincial population.

Northeastern New Brunswick

In total, 28 sites were visited in 1996 compared to 25 in 1991. Most sites had fewer adult plovers in 1996. Serious declines were observed at Grand Passage and the Neguac, Tabusintac and Cedar Road sandspits. However, more plovers were observed at Ward Road North (Grande Plaine), Pokemouche South (Plover Ground) and Pointe à Bouleau when compared to 1991 census estimates.

Fledging rates were not determined in 1996, however data had been compiled for the six previous years. The highest fledging success ever achieved in the Acadian peninsula was observed in 1995 on beaches with symbolic fencing and coastal guardians. Aided by these conservation measures, 26 pairs located on five beaches achieved an average fledging rate of 2.23 young fledged per nesting pair. The fledging rate for all pairs in northeastern New Brunswick, during 1995, was 1.65 young fledged per pair from a total of 54 pairs with a total of 89 young fledged (LeBreton 1995).

Kouchibouguac National Park

All potential habitats were covered during the census, including a total of 28.2 km of beach. Twenty-two adults consisting of ten pairs were recorded (Table 1), indicating a decline of 27 % and 33% respectively, when compared to the 1991 census (Table 2).

Another two pairs were discovered after the census period and therefore a total of 12 pairs nested in KNP in 1996. In total, 54 eggs were laid, of which 20 hatched and 13 chicks fledged. The hatching rate for 1996 was 1.67 eggs/pair and the fledging rate was 1.08 chicks/pair.

Depredation does not seem to have increased although the first observed case of depredation by gulls occurred during 1996. Human disturbance through all-terrain vehicle (ATV) traffic was higher in the northern section of the Park on Pointe Sapin Beach. More coastal patrols by Park Wardens were conducted during the summer of 1996 than in previous years resulting in a charge against an individual found in a Piping Plover nesting area.

Discussion

Results of the 1996 International Piping Plover Census appear to confirm the decline in Piping Plover numbers as suggested in a mini-census conducted in 1994. A decrease of 28% has occurred since 1991, despite indications of good production in most of the province during recent years. The 146 adult plovers represents the second lowest counts for the province since records have been kept, after the low count reported in the 1994 mini-census. Because the mini-census represents only a partial survey, it is difficult to determine whether there has been a further reduction or increase in numbers since 1994. Population estimates have previously been reported in the range of 145 to 227 birds for New Brunswick (Amirault et al. 1997; Table 3). The trend in provincial numbers is most likely downward because early survey efforts may not have included sites that were identified for the purposes of the 1991 International Census. Fewer birds are now being counted on provincial beaches despite the fact that more beaches are being censused.

Northeastern New Brunswick

The 1996 census resulted in one of the lowest counts ever recorded for northeastern New Brunswick. These results were unexpected considering the good fledging success documented in 1995. It appears that a slow decline may be occurring in this area (Chiasson and Dietz 1996).

The reason for the serious decline on three beaches (Neguac, Tabusintac Spit and Cedar Road South) is unknown. Grand Passage is essentially free of human disturbance however this site has experienced some habitat loss due to increased vegetation in the nesting area. The other sites may have been impacted by human disturbance and depredation. Sites where losses have occurred will require careful monitoring to determine the cause of the decline and further effort to improve fledging success.

Beaches with high human disturbance including the illegal use of ATVs continue to have low fledging success. While intensive public education (i.e., guardian and school programs), enhanced enforcement efforts, symbolic fencing and coastal guardians should be continued to resolve disturbance problems, research must be initiated to determine potential causes for the apparent low rate of return to areas surrounding natal beaches.

Depredation continues to be a minor cause of poor fledging success. The huge expanses of suitable nesting habitat apparently may make it difficult for predators to find eggs and young. The carrying capacity of Piping Plover nesting habitat in this region does not appear to have been achieved.

Kouchibouguac National Park

The decline in the number of birds recorded during the period between International Censuses has subsequently led to a reduced number of young fledged in the 1996 season (13 young fledged in 1996 compared to 21 in 1991). Hatching rate was poor as well, due to abandonments caused by storms and flooding, depredation and increased human disturbance. Similarly to the northeastern New Brunswick area, these results were unexpected due to the good fledging success recorded in KNP for the 1995 season. Some habitat changes have occurred since the 1991 census and could be partly responsible for the lower number of birds observed during 1996.

Human disturbance through ATV use in the northern section of the Park continues to be a problem. However, for the first time in the history of KNP, charges under the National Parks Act were laid for entering a closed breeding area in the summer of 1996. Educational programs are regularly provided to visitors at the Park by Interpretation staff and complete closure of Piping Plover nesting areas continues to be enforced in KNP.

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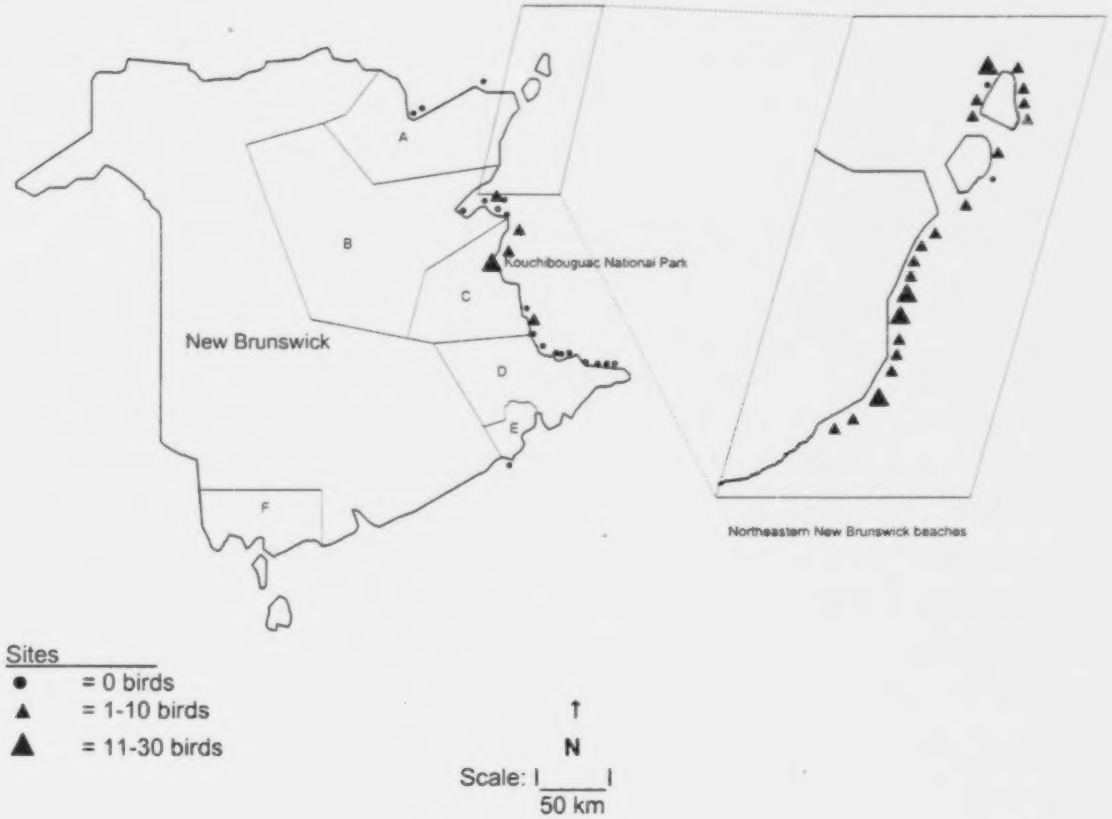
Figure 1. Distribution of Piping Plovers in New Brunswick, 1996.


A
B
C
D
E
F
New Brunswick
Kouchibouguac National Park
Northeastern New Brunswick beaches
Sites
● = 0 birds
▲ = 1-10 birds
▲ = 11-30 birds
N
Scale: I_____I
50 km

Location	County	Adults/pairs
A	Gloucester	81/37
B	Northumberland	32/13
C	Kent	33/15
D	Westmorland	0/0
E	Albert	0/0
F	Charlotte	no beaches surveyed in 1996

Table 1. Locations and numbers of Piping Plovers found in New Brunswick in 1996.

Site	Map sheet	Date	Distance covered (km)	No observers	No. adults	No. singles	No. pairs	% habitat covered
Beresford	21P/12	8 June	3.0	2	0	0	0	70
Carron point	21P/12	9 June	3.0	2	0	0	0	100
Maissonnette	21P/15,16 & 22A/1,2	9 June	6.0	1	0	0	0	100
Ward Road South	21P/15,16 & 22A/1,2	15 June	1.5	4	0	0	0	100
Ward Road North	21P/15,16 & 22A/1,2	15 June	2.4	4	12	0	6	100
Lac Frye	21P/15,16 & 22A/1,2	15 June	2.5	4	2	0	1	100
Miscou Beach	21P/15,16 & 22A/1,2	16 June	3.5	4	2	0	1	100
Middle Miscou Beach	21P/15,16 & 22A/1,2	16 June	2.5	4	2	0	1	100
Wilson Point	21P/15,16 & 22A/1,2	16 June	1.7	4	2	0	1	100
Sandy Point	21P/15,16 & 22A/1,2	16 June	1.8	4	2	0	1	100
Pigeon Hill	21P/15,16 & 22A/1,2	5 June	1.0	3	3	1	1	100
Cap Bateau	21P/15,16 & 22A/1,2	5 June	1.0	3	0	0	0	100
Chiasson Office	21P/10	5 June	3.7	6	2	0	1	100
École la Vague	21P/10	5 June	1.0	3	4	0	2	100
Le Goulet	21P/10	8 June	1.0	2	3	1	1	100
Grand Passage	21P/10	6 June	3.0	2	8	0	4	100
Pokemouche South	21P/10	5,14 June	4.0	5	7	1	3	100
Green Point South	21P/10	6 June	5.0	3	4	0	2	100
Tracadie Dune	21P/10	18 June	4.0	2	12	2	5	100
Pointe à Bouleau	21P/10	6 June	3.0	3	14	2	6	100
Val Comeau	21P/7	4 June	4.0	2	2	0	1	100
Pointe à Barreau	21P/7	5 June	2.0	2	2	0	1	100
Cedar Road South	21P/7	5 June	8.0	2	7	1	3	100
Tabusintac Spit	21P/7	8 June	4.0	2	12	2	5	100
Blacklands Spit	21P/7	14 June	2.0	2	2	2	0	100
Neguac	21P/7	3 June	6.0	2	6	0	3	100
Portage Island NWA[a]	21P/3	4 June	19.0	4	3	1	1	100
Fox Island	21P/3	5 June[b]	26.0	4	0	0	0	100
Hucklebery Island	21P/3	5 June	-[b]	4	0	0	0	100
Little Huckleberry Island[c]	21P/2	5 June		2	0	0	0	?
Sheldrak Island	21P/3	3 June	2.0	4	0	0	0	100
Preston Beach	21P/2	3 June	4.5	4	0	0	0	100
Escuminac Beaches	21P/2	9 June	8.25	1	4	0	2	100
Pointe-Sapin Beach	21I/15	9 June	4.0	1	2	0	1	52
Kouchibouguac NP[d]	21I/10	4,5,7,9 June	28.2	6	22	2	10	100
South Richibucto Dune	21I/10	3 June	8.5	1	0	0	0	100
Buctouche Bar	21I/7	5 June	14.0	3	5	1	2	100
Bar de Cocagne	21I/7	6 June	1.5	1	0	0	0	100
Pointe Grande-Digue	21I/7	6 June	3.0	1	0	0	0	100
Cap Brûlé East	21I/1	9 June	2.0	2	0	0	0	100
Cap Bimet West	21I/1	9 June	2.0	2	0	0	0	100
Petit Barachois	21I/1	9 June	2.5	2	0	0	0	100
Landry East	21I/1	7 June	0.8	2	0	0	0	100
Little Cape	21I/1	7 June	2.0	2	0	0	0	100
Johnston Point	21I/1	7 June	2.2	2	0	0	0	100
Cadman Beach	21I/1	7 June	1.4	2	0	0	0	100
Waterside Beach	21H/10	June	1.0	1	0	0	0	100
Totals			213.45		146	16	65	

[a] National Wildlife Area.

[b] Huckleberry Island was included in the Fox Island survey, together 26 km were surveyed.

[c] Little Huckleberry Island was observed from Preston Beach and Huckleberry Island using binoculars.

[d] National Park.

Table 2. Comparison of 1991 and 1996 Piping Plover population counts.

Site	No. adults		No. pairs		Percent change	
	1991	1996	1991	1996	No. adults	No. pairs
Bereford	NC[a]	0	NC	0	-	-
Carron Point	0	0	0	0	0	0
Maisonnette	0	0	0	0	0	0
Ward Road South	0	0	0	0	0	0
Ward Road North	4	12	0	6	+200	+[b]
Lac Frye	4	2	2	1	-50	-50
Miscou beach	3	2	1	1	-33	0
Middle Miscou Beach	NC	2	NC	1	-	-
Wilson Point	3	2	1	1	-33	0
Sandy Point	3	2	1	1	-33	0
Fox Dens	0	NC	0	NC	-	-
Pigeon Hill	5	3	2	1	-40	-50
Cap Bateau	NC	0	NC	0	-	-
Chiasson Office	NC	2	NC	1	-	-
École la Vague	NC	4	NC	2	-	-
Le Goulet	6	3	3	1	-50	-67
Grand Passage	20	8	10	4	-60	-60
Pokemouche South	5	7	2	3	+40	+50
Green Point South	10	4	5	2	-60	-60
Tracadie Dune	12	12	6	5	0	-17
Pointe à Bouleau	13	14	6	6	+8	0
Val Comeau	2	2	1	1	0	0
Pointe à Barreau	NC	2	NC	1	-	-
Cedar Road South	16	7	8	3	-56	-63
Tabusintac Spit	21	12	7	5	-43	-29
Blacklands Spit	NC	2	NC	0	-	-
Neguac	19	6	8	3	-68	-63
Portage Island NWA[c]	2	3	1	1	+50	0
Fox Island	0	0	0	0	0	0
Huckleberry Island	0	0	0	0	0	0
Egg Island	0	NC	0	NC	-	-
Little Huckleberry Island	NC	0	NC	0	-	-
Sheldrake Island	0	0	0	0	0	0
Preston Beach	1	0	0	0	-100	0
Escuminac Beaches	NC	4	NC	2	-	-
Pointe-Sapin Beach[d]	0	2	0	1	+	+
Kouchibouguac NP[e]	30	22	15	10	-27	-33
South Richibucto Dune	4	0	2	0	-100	-100
Buctouche Bar	14	5	7	2	-64	-71
Bar de Cocagne	0	0	0	0	0	0
Pointe Grande-Digue	0	0	0	0	0	0
Cap Brûé East	0	0	0	0	0	0
Cap Bimet West	0	0	0	0	0	0
Petit Barachois	2	0	1	0	-100	-100
Landry East	0	0	0	0	0	0
Little Cape	2	0	1	0	-100	-100
Johnston Point	0	0	0	0	0	0
Cadman Beach	0	0	0	0	0	0
Waterside Beach	2	0	1	0	-100	-100
Long Pond Beach	0	NC	0	NC	-	-
Totals	203	146	91	65	-28.1	-28.6

[a] NC = not censused.

[b] + with no number = adult(s) or pairs present in 1996 but not in 1991.

[c] Larger area censused in 1996.

[d] NWA = National Wildlife Area.

[e] NP = National Park.

Table 3. New Brunswick Piping Plover population estimates 1987- 1996.

Year	Adults	Pairs
1987	227	85
1988	190	95
1989	178	89
1990	177	87
1991	203	91
1992	132[a]	64
1993	150[a]	73
1994	145	63
1995	160	73
1996	146	65

[a] Census of Acadian Peninsula and Kouchibouguac National Park only.

2.5 Recensement du Pluvier siffleur au Québec, en 1996

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Résumé

Un inventaire systématique des habitats potentiels du Pluvier siffleur *Charadrius melodus* au Québec a été effectué en 1996 dans le cadre du second recensement international de cette espèce. L'inventaire a couvert plus de 236 km de plages propices, réparties en trois régions géographiques. Aucun Pluvier siffleur n'a été recensé dans les régions de la Basse-Côte-Nord et de la Gaspésie, bien que l'espèce y ait déjà été présente. Dans l'archipel des Îles-de-la-Madeleine, 104 individus ont été dénombrés. Ces résultats confirment d'une part l'abandon par le Pluvier siffleur des plages des régions de la Gaspésie et de la Basse-Côte-Nord et indiquent d'autre part une amélioration de la situation aux Îles-de-la-Madeleine par rapport aux résultats du premier inventaire international, réalisé en 1991.

Abstract

A systematic survey of the potential habitat of Piping Plover *Charadrius melodus* in Québec was carried out as part of the 1996 International Piping Plover Census. The inventory covered more than 236 km of habitat in three geographic areas. There were no sightings of Piping Plovers in the Lower North Shore or the Gaspé Peninsula, despite their historic presence in the two regions. In the Îles-de-la-Madeleine (Magdalen Islands), 104 birds were counted. These results confirm the abandonment of the Gaspé Peninsula and the Lower North Shore area and an improvement of the situation in the Îles-de-la-Madeleine compared to results of the 1991 International Piping Plover Census.

Introduction

En 1991, un premier inventaire international du Pluvier siffleur *Charadrius melodus* a été réalisé afin d'obtenir l'image la plus exacte possible de sa répartition ainsi que de la taille de sa population et ce, aussi bien dans les territoires de reproduction que dans les aires d'hivernage (Haig et Plissner 1993). Le fait de pouvoir répéter ce type d'inventaire avec la même méthodologie favorise une comparaison des résultats et permet de mieux évaluer l'efficacité des mesures de rétablissement mises en place pour sauvegarder cette espèce en danger de disparition. Au Québec, le Pluvier siffleur se trouve à la limite septentrionale de son aire de reproduction. Il se rencontrait historiquement dans trois régions géographiques soit la Gaspésie, la Basse-Côte-Nord et les Îles-de-la-Madeleine. La première mention de présence du Pluvier siffleur au Québec date de la première moitié du XIX^{e} siècle, alors qu' Audubon le considérait comme un oiseau nicheur abondant aux Îles-de-la-Madeleine (Audubon 1940). Au cours du présent siècle, cette espèce a fait l'objet de plusieurs rapports d'observations et de quelques inventaires systématiques, lesquels ont été rapportés et résumés par Laporte et Shaffer (1994) et par Shaffer et Laporte (1995).

Le présent compte-rendu fournit les données obtenues dans le cadre de Recensement international du Pluvier siffleur de 1996. Une analyse de la tendance des effectifs de cette espèce aux Îles-de-la-Madeleine est également présentée, en relation avec les mesures de protection mises en place depuis plusieurs années.

Méthode

La méthode utilisée pour réaliser l'inventaire de 1996 est identique à celle employée en 1991 (Laporte et Shaffer 1994). Afin d'assurer l'uniformité avec l'inventaire de 1991, les mêmes plages furent couvertes dans les régions de la Gaspésie et de la Basse-Côte-Nord. Il en est de même aux Îles-de-la-Madeleine, sauf qu'une nouvelle plage s'est ajoutée à la liste, soit celle de Procul-Bourgeois. Tous les secteurs recensés ont été visités à pied; les véhicules motorisés ont été uniquement utilisés pour se déplacer entre les différentes plages. Pour la Basse-Côte-Nord, l'inventaire s'est déroulé du 10 au 16 juin, à l'exception de la plage de Chevery qui a été visitée le 12 juillet ; deux observateurs ont couvert 79,7 km de plage, soit

23,2 km de plus qu'en 1991. En Gaspésie, l'inventaire s'est échelonné du 11 au 13 juin ; deux personnes ont couvert 26,0 km de plage. La distance ainsi parcourue en Gaspésie est supérieure de 6,1 km à celle inventoriée en 1991. En ce qui concerne l'archipel des Îles-de-la-Madeleine, le recensement s'est déroulé en une seule journée, soit le 15 juin, avec la collaboration de 41 membres du Club d'ornithologie des Îles-de-la-Madeleine et d'Attention FragÎles. La plage de l'île Brion a pour sa part été recensée le 28 juin. Tous les habitats potentiels ont été couverts, ce qui représent 130,7 km de plages. Par ailleurs, les informations récoltées lors des nombreuses visites des plages effectuées au cours de l'été, afin de mesurer la productivité de l'espèce ou de mettre en place des mesures de protection, sont venues compléter les résultats.

Résultats

Les plages présentant des habitats potentiels pour le Pluvier siffleur sont indiquées au tableau 1 pour la région de la Basse-Côte-Nord et au tableau 2 pour celle de la Gaspésie. Dans ces deux régions, aucun Pluvier siffleur n'a été observé. Depuis l'inventaire de 1991, aucun indice ou observation laissant croire que l'espèce aurait pu s'y trouver à nouveau, n'a été rapporté (Laporte et Shaffer 1994 ; Shaffer et Laporte 1995).

Aux Îles-de-la-Madeleine, l'inventaire effectué au cours de la journée du 15 juin a permis de dénombrer 87 Pluviers siffleurs. Les détails des résultats apparaissent au tableau 3. Par ailleurs, un inventaire des nids échelonné sur l'ensemble de la période de reproduction, réalisé afin de mettre en oeuvre des moyens de protection contre la circulation motorisée et le dérangement sur les plages, permet de préciser ce dénombrement. Ainsi, avec le nombre de nids initiaux retrouvés sur chaque plage (tableau 3), c'est-à-dire excluant les secondes tentatives après une destruction, on est en mesure de déterminer pour chaque section de plage, le nombre d'oiseaux ayant échappé à l'attention des observateurs. En tenant compte de ces informations, les effectifs de la population de Pluviers siffleurs des Îles-de-la-Madeleine se chiffrent à 104 individus en 1996.

Discussion

Pour les régions de la Basse-Côte-Nord et de la Gaspésie, les résultats de l'inventaire international de 1996 viennent confirmer ceux de 1991, à savoir l'absence du Pluvier siffleur dans les habitats potentiels de ces régions, là où il était autrefois présent (Laporte et Shaffer 1994). Avec les augmentations récentes des populations de pluviers aux Îles-de-la-Madeleine et particulièrement à Terre-Neuve (Knox et al. 1994 ; Brazil et al. ce volume), on aurait pu s'attendre à une recolonisation de certains habitats sur la Basse-Côte-Nord. Cette hypothèse est justifiée d'autant plus qu'à plusieurs endroits, l'habitat demeure propice à la nidification de l'espèce.

La situation en Gaspésie est quelque peu différente. Les plages y sont fortement perturbées par les activités humaines et plusieurs d'entre elles ont subit des modifications d'origine naturelle ou humaine faisant en sorte qu'elles offrent maintenant un potentiel réduit pour la reproduction du Pluvier siffleur. Seul le secteur de Paspébiac offre encore un potentiel intéressant pour l'espèce.

Les Îles-de-la-Madeleine demeurent l'endroit de prédilection pour la reproduction du Pluvier siffleur au Québec, puisque l'espèce y est encore bien établie. Les résultats de l'inventaire de 1996 représentent une hausse de 37 % par rapport à 1991. L'analyse des données historiques présentée avec les résultats de l'inventaire international de 1991 dans Laporte et Shaffer (1994) indiquait que la population de Pluviers siffleurs au début des années 1980 était inférieure à celle du début de la décennie 90. Les effectifs sont donc en hausse depuis quelques années comme le démontre les résultats des inventaires effectués annuellement entre 1987 et 1996, à l'exception de 1988. La population est passée de 70 individus en 1989 et 1990 pour atteindre 106 et 104 oiseaux en 1995 et 1996 respectivement (Roy et D'Amours 1996).

À l'instar de l'inventaire de 1991, l'inventaire de 1996 aux Îles-de-la-Madeleine a été effectué de deux manières indépendantes. Dans le cadre du programme de protection des sites de reproduction et d'une étude sur la productivité des couples, l'ensemble des plages des Îles-de-la-Madeleine ont été parcourues à plusieurs reprises. Basée sur l'analyse de ces données, la population reproductrice était de 52 couples reproducteurs, soit 104 individus. D'autre part, l'inventaire effectué en une seule journée sur l'ensemble des plages des Îles-de-la-Madeleine a permis de dénombrer 87 individus, ce qui représente un rapport de 1,20. En 1991, lors du premier inventaire international, a rapport avail été de 1,25 alors qu'en 1993 et 1997, nous avons obtenu des valeurs de 1,23 et 1,32 respectivement (Laporte et Shaffer 1994). La valeur moyenne de 1,25 représente donc le facteur de correction utilisable pour obtenir un estimé de la population reproductrice de Pluviers siffleurs à partir d'un dénombrement systématique effectué en une seule journée sur les plages des Îles-de-la-Madeleine.

L'augmentation des effectifs de Pluviers siffleurs aux Îles-de-la-Madeleine s'explique par un ensemble de facteurs. Depuis 1989, la mise en place de mesures de protection des aires de reproduction de l'espèce et des campagnes de sensibilisation du public à la problématique du Pluvier siffleur ont été développées et appliquées (D'Amours 1992; Roy et D'Amours 1996). Un des effets directs de ces mesures a été de réduire l'écrasement et le dérangement de nids de Pluviers siffleurs par la circulation motorisée sur les plages. De 1991 à 1996, une seule destruction de nid a pu être attribuée à une cause humaine, comparativement à 10 de 1987 à 1990 (Shaffer et Laporte 1992a ; Roy et D'Amours 1996). Entre 1989 et 1991, la productivité du Pluvier siffleur a varié de 1,3 à 1.5 jeunes par couple reproducteur, basée sur un âge d'envol de 25 jours, alors qu'elle a été de 2,0 jeunes par couple en 1992 (Shaffer et Laporte 1992a ; Shaffer et Laporte 1992b). Cette productivité s'est avérée suffisamment importante pour expliquer l'augmentation des effectifs enregistrée aux Îles-de-la-Madeleine les années subséquentes. Par ailleurs, une productivité de seulement 0,62 jeune par couple a été mesurée en 1996. Comme la mesure de la productivité n'a pas été effectuée de 1993 à 1995, on ignore si cette faible productivité s'est manifestée uniquement en 1996. Quoiqu'il en soit, un si faible succès de reproduction aura probablement comme conséquence une baisse éventuelle de la population. Les causes de cette faible productivité sont difficilement identifiables. Toutefois, les observations semblent suggérer une augmentation de la prédation depuis quelques années. En effet, le nombre de nids détruits par prédation et par des causes inconnues (surtout associées à des cas de prédation) a augmenté depuis 1991 (Shaffer et Laporte 1992a; Roy et D'Amours 1996 ; Roy 1996). La prédation a pu s'accroître suite au moratoire sur le trappage du Renard roux (*Vulpes vulpes*) aux Îles-de-la-Madeleine, qui a été appliqué au cours de la première moitié des années 1990.

Ce moratoire a permis à ce mammifère d'augmenter considérablement ses effectifs. De plus, la fermeture de plusieurs dépotoirs à ciel ouvert au printemps 1993 a obligé les populations de goélands, de corbeaux et de corneilles à chercher de nouvelles sources de nourriture. La prédation des oeufs et des jeunes Pluviers siffleurs a donc pu augmenter. Si un haut niveau de prédation persiste, il faudra prévoir des moyens pour diminuer ce phénomène et ainsi de permettre à la population de Pluviers siffleurs des Îles-de-la-Madeleine de s'accroître.

Remerciements

Nous tenons d'abord à souligner la précieuse participation de Michel Robert du Service canadien de la faune, qui a parcouru le territoire de la Basse-Côte-Nord. La réalisation d'un tel inventaire repose inévitablement sur la participation de nombreuses personnes dévouées à la cause de la protection du Pluvier siffleur. Nous tenons donc à remercier tous les bénévoles qui ont participé à ce recensement : Marie-Josée Arseneau, Bertrand Bénard, Chantal Bénard, Nancy Bénard, François Bourque, Jacques Bourque, Jean-Sébastien Bourque, Myriam Bourque, Chantal Cyr, Danielle Cyr, Lise Cyr, Sébastien Cyr, Isabelle Daigneault, Lucie D'Amours, Gérald Domon, Manon Dubé, Philippe Fragnier, Carol Ann Gaudet, Donna Gail Gaudet, Raymond Gauthier, Isabelle Hubert, Nicolas Jomphe, Annie Landry, Édouard Leblanc, Denise Lelièvre, Yolande Lemire, Camille Leroux, Sylvie Lessard, Luc Longuépée, Annie Martinet, Selma Pereira, Jacques Poirier, Paule Potvin, Alain Richard, Jean-Claude Richard, Noël Richard, Yves Richard, Martine Rioux, Damien Turbide, Olivier Turbide et Nathalie Vallée. Des remerciements vont aussi à l'équipe d'Attention FragÎles, particulièrement à Patricia Bell, Bernise Leblanc et Claude Roy pour l'organisation de la journée d'inventaire aux Îles-de-la-Madeleine.

Tableau 1. Résultats de l'inventaire international du Pluvier siffleur dans la région de la Basse-Côte-Nord en 1996.

Site	Longueur (km)	Date de l'inventaire	Longueur inventoriée (km)	N[a]
Rivière-Brochu (plage est)	6,7	10 juin	6,7	0
Plage Ste-Marguerite, Sept-Îles	1,7	10 juin	1,7	0
Baie des Boules, Sept-Îles	5,7	11 juin	5,7	0
Moisie	2,5	11 juin	2,5	0
Matamec	7,5	11 juin	7,5	0
Rivière-aux-Graines	5,6	12 juin	1,5	0
Rivière Saint-Jean	3,3	13 juin	3,3	0
Longue Pointe	6,5	13 juin	6,5	0
Baie de Mingan, Mingan	9,0	14 juin	9,0	0
Pointe Materteux, Mingan	1,5	13 juin	1,5	0
Pointe du Curé, Mingan	3,2	13 juin	2,8	0
Pashashibou	4,5	16 juin	4,5	0
Aguanish	12,0	16 juin	12,0	0
Natashquan	6,8	15 juin	5,5	0
Île Sainte-Hélène	2,0	15 juin	2,0	0
Pointe du Vieux-Poste	4,0	15 juin	4,0	0
Chevery	3,0	12 juillet	3,0	0
Totals	85,5	-	79,7	0

[a] Nombre d'individus recensés.

Tableau 2. Résultats de l'inventaire international du Pluvier siffleur dans la région de la Gaspésie en 1996.

Site	Longueur (km)	Date de l'inventaire	Longueur inventoriée (km)	N[a]
Barre de Sandy Beach, Gaspé	4,7	11 juin	3,5	0
Plage Haldimand, Douglastown	2,5	11 juin	2,5	0
Coin-du-Banc, Barachois	9,0	11 juin	7,0	0
Plage du Grand Pabos, Chandler	2,3	12 juin	2,3	0
Anse aux Îlots, Newport	0,9	12 juin	0,9	0
Paspébiac	2,0	12 juin	2,0	0
New-Carlisle	3,0	12 juin	3,0	0
Bonaventure	2,1	13 juin	2,1	0
Île Laviolette, St-Omer	2,5	13 juin	2,0	0
Île aux Groseilles, St-Omer	0,7	13 juin	0,7	0
Totals	29,7	-	26,0	0

[a] Nombre d'individus recensés.

Table 3. Résultats de l'inventaire international du Pluvier siffleur aux Îles-de-la-Madeleine en 1996.

Site	Longueur inventoriée (km)	Individus reproducteurs	Inventaire du 15 juin	
			isolés	individus en couples
Sandy Hook	12,2	4	1	2
Plage du Havre	4,4	0	0	0
Dune du Bassin	3,2	0	0	0
Plage de l'Ouest	11,0	20	0	18
Plage Martinique-Havre Aubert	12,6	18	0	12
Procul-Bourgeois	0,8	2	0	2
La Digue	2,1	2	0	2
La Pointe	1,5	4	1	2
Dune du Nord (Plage de l'Hôpital)	17,5	8	0	4
Dune du Nord	16,4	2	0	2
Dune du Sud	19,9	20	1	18
Pointe de l'Est	19,5	8	0	8
Bassin aux Huîtres (est)	1,7	12	0	12
Bassin aux Huîtres (Ouest)	0,6	2	0	0
Pointe de la Grande-Entrée	0,8	0	0	0
Îlot B	1,0	0	0	0
Îlot C	2,0	2	0	2
Île Brion	3,5	0	0	0
Totals	130,7	104	3[a]	84[a]

[a] Total individus = 87.

2.6 The 1996 Piping Plover census in Ontario

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Abstract

Former and existing breeding locations of the Piping Plover *Charadrius melodus* in Ontario were censused as part of the 1996 International Piping Plover Census. Three adult birds were observed on 13 June 1996 at Windy Point, Lake of the Woods. One other Piping Plover was sighted at Beaverton on 2 June 1996. During the 1991 International Piping Plover Census, five adult birds were observed on the Sable Islands, Lake of the Woods (Heyens 1994). A small remnant population of plovers continues to breed in the Ontario portion of Lake of the Woods (Windy Point and/or the Sable Islands). Conservation measures include the use of predator exclosures on all nests and signage of nesting habitat to prevent human disturbance during the nesting period.

Résumé

Les aires de nidifications anciennement et présentement utilisées par le Pluvier siffleur *Charadrius melodus* en Ontario ont été recensées dans le cadre du recensement international de 1996. Trois oiseaux adultes ont été observés le 13 juin 1996 au cap Windy Point du lac des Bois. Un autre spécimen a été vu à Beaverton le 2 juin 1996. À l'occasion du recensement de 1991, cinq adultes avaient été observés sur les îles Sable du lac des Bois (Heyens 1994). Une petite population de pluviers continue à se reproduire dans la partie ontarienne du lac des Bois (au cap Windy Point et/ou sur les îles Sable). Les mesures de conservation consistent entre autres à exclure les prédateurs des zones de nids et à installer des panneaux pour éviter les perturbations dues à l'homme pendant la saison de nidification.

Introduction

An intensive survey of former breeding locations of the Piping Plover in Ontario was conducted during 1996 as part of the International Piping Plover Census. Former breeding locations along the Lake Erie and Georgian Bay shorelines and known breeding locations at Lake of the Woods, Ontario, were surveyed as part of this census. In addition, a number of potential breeding sites at Sault Ste. Marie, Ontario (Lake Huron and Lake Superior shorelines and offshore islands) were censused during 1996. This paper describes the 1996 census results in comparison to the 1991 census and where possible, relates these results to historical numbers and distribution of the Piping Plover in Ontario. Lastly, a brief discussion is included which summarizes the status of the plover in Ontario and conservation measures to protect this endangered species.

Methods

Seventeen locations within Ontario were censused during 1996 (Table 1) compared to three locations censused during the 1991 survey. All of these locations were surveyed on foot with some locations requiring the use of a boat to access offshore islands.

Two known plover nesting sites on the Ontario portion of Lake of the Woods were censused twice during the survey period. Windy Point and the Sable Islands Provincial Nature Reserve were surveyed on 5 and 6 June, respectively. No plovers were observed on these dates with inclement weather conditions present (high winds and rain). These locations were again surveyed on 13 June under more favourable weather conditions. These sites were accessed by boat from Kenora, Ontario. The entire length of the Sable Islands (6 km) was walked, and approximately 1 km of suitable habitat at the tip of Windy Point was covered on foot during both surveys.

A number of small sand beaches on the south side of Big and Bigsby islands (Lake of the Woods) were also surveyed during 1996. Ten potential nesting sites were surveyed on

Lake Superior and Lake Huron from Sault Ste. Marie, Ontario. Former nesting locations at Wasaga Beach (Georgian Bay) and Long Point (Lake Erie) were also surveyed during 1996.

Results

Piping Plovers were located at only one of the 17 sites censused (Table 1). Three adults were observed at Windy Point, Lake of the Woods on 13 June 1996. One pair of territorial plovers was defending a nest which contained two eggs. The other plover appeared to be an unpaired bird and was continually being chased by the mated pair. A predator exclosure was erected over the nest. It took approximately ten minutes to erect the exclosure and a plover return to incubate the eggs approximately one minute after we departed to a safe distance. The predator exclosure consisted of 5 cm x 5 cm wire mesh, 1.75 m high with an approximate diameter of 2 m. The wire mesh was buried in the sand approximately 16 cm deep and supported by four 2 m lengths of 1.5 cm re-bar. Coloured string was randomly strung across the top of the exclosure. In addition, two endangered species signs prohibiting public access were erected on each side of the nest site (approx. 100 m).

The predator exclosure was next checked on 3 July 1996. The nest was empty and did not appear to have been predated. Two adult plovers were observed. One of the adults appeared to be aggressive towards the other adult and kept chasing it within the immediate area. An extensive effort was not made to locate fledged young. The exclosure and the endangered species signs were removed. Windy Point was again surveyed on 21 July 1996 and no plovers were observed.

Piping Plovers were not observed at any of the remaining 16 surveyed sites during 1996. One adult plover was observed at Beaverton (near Lake Simcoe) on 2 June 1996 (Bain 1996). This was a banded bird and was most likely banded as a chick in Michigan during 1995 (Jon McCracken, Long Point Bird Observatory).

General Comments

Weather conditions were less than ideal during the 5 and 6 June survey dates with rain and high winds occurring on both days. The subsequent survey on 13 June was conducted during sunny, clear weather conditions.

Water levels on Lake of the Woods were high during the nesting period (elevation 323.5 m ASL on 13 June 1996). Beach areas were greatly reduced resulting in less suitable habitat for Piping Plovers in 1996 than in 1991. This situation was very obvious on the tip of Windy Point with terns, gulls and the one plover nest all in very close proximity to each other.

Discussion

The Piping Plover was once widespread throughout the Great Lakes Region with numbers estimated to be approximately 150 breeding pairs (Cadman et al. 1987). Substantial population declines occurred during the 1960's and 70's with the last known breeding in southern Ontario occurring in 1977 at Long Point Beach on Lake Erie (Lambert and Nol 1978). Piping Plovers are still occasionally seen at Long Point and Turkey Point. However, these birds appear to be transients as they do not remain at these sites during the breeding season.

A variety of explanations have been put forward to explain the population decline. It would appear that one of the primary reasons is the increasing use of beach habitat for recreational purposes. The destruction of nests and young by pedestrian and vehicular traffic and the disturbance of nesting birds by recreationists are the main concerns. Increasing numbers of natural predators such as raccoons *(Procyon lotor)*, red foxes *(Vulpes Vulpes)*, gulls *(Larus spp.)* and American Crows *(Corvus brachyrhynchos)* may have contributed to the decline (Cairns and McLaren 1980).

A small population of Piping Plovers continues to breed in the extreme northwest portion of the province on Lake of the Woods. This population consists of an Ontario and

Minnesota segment. The Minnesota population breeds primarily on two off-shore barrier sand islands (Pine and Curry islands). This group has continued to decline from a high of approximately 50 adults during the early 1980's to 10 adults in 1996 (Maxson et al. 1996).

In recent years, the Ontario population has been restricted to the Sable Islands Provincial Nature Reserve and to Windy Point (Fig. 1). The number of adult plovers observed on the Sable Islands remained relatively constant until 1992 when no plovers were observed (Table 2). Plovers were not observed on the Sable Islands during the 1995 and 1996 breeding seasons. Prior to 1995, plovers would occasionally be observed on Windy Point, although nesting success was very poor. It would appear that predation by red foxes and Ring-billed Gulls (*Larus delawarensis)* were the primary factors contributing to unsuccessful nesting attempts at this site. The very tip of Windy Point was breached by a late 1994 fall storm and has resulted in a small island being formed at the tip of the point. Since this event, at least one pair of plovers has successfully nested on Windy Point during the 1995 and 1996 breeding seasons. This small offshore island now presents a barrier to mammalian predators and coupled with the use of predator exclosures, nests are not being predated prior to hatching.

It does not appear that the availability of suitable habitat on Windy Point or on the remainder of Lake of the Woods is a limiting factor to the viability of this population. An investigation of 19 sites by Lambert and Risley (1989), found that six of these sites were categorized as fair or good habitat, while the remaining sites were categorized as marginal or unsuitable habitat.

Extensive habitat is available at the Sable Islands. The major threats to this population are from recreationists and fluctuating water levels on Lake of the Woods. Both of these impacts are manageable and attempts have been made by the Ontario Ministry of Natural Resources to educate recreationists regarding the protection of Piping Plovers and their habitat requirements. Signage is in place at three separate locations on the Sable Islands advising recreationists of the protected status of the islands and that the use of all-terrain vehicles is prohibited. During the 1996 breeding season, endangered species signs were erected on Windy Point to prevent human disturbance of the nesting plovers. The Lake of the

Woods Water Control Board is the agency responsible for controlling water levels on the lake and has been made aware of the habitat requirements of this endangered species.

In conclusion, a small remnant population of Piping Plovers continues to breed in northwestern Ontario at Lake of the Woods. The 1991 and 1996 international censuses documented five and three adults at this location, respectively. Plovers continue to be occasionally reported from other parts of Ontario as well (Heyens 1986-88, 1990-96). However, these birds appear to be transients and do not breed at these locations. Annual censuses will be carried out on the Lake of the Woods population and predator exclosures and endangered species signage will continue to be used at or near any nest sites.

Acknowledgements

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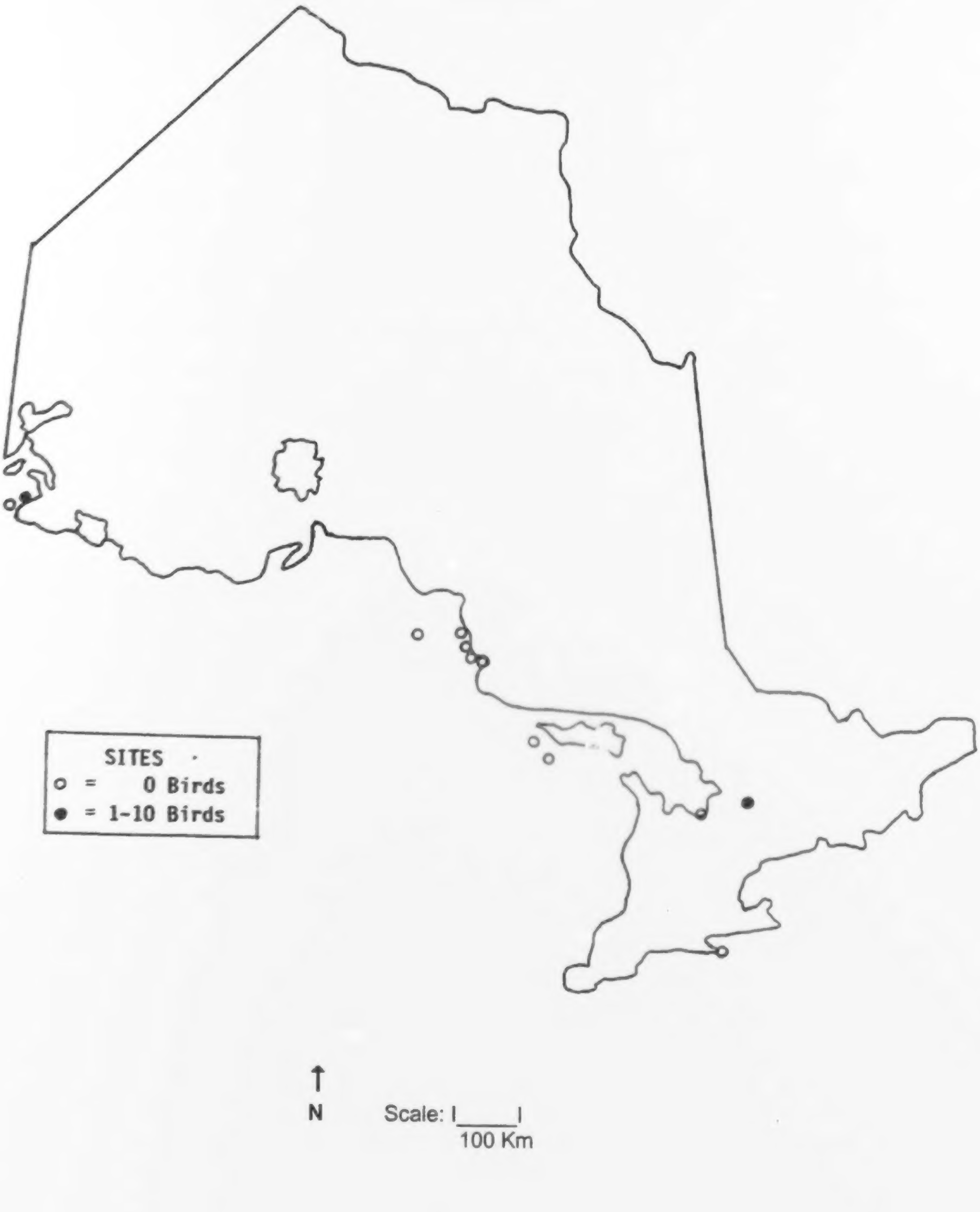
Finally, I would like to thank Mr. Tony Beyak for his continued support of the Piping Plover Program and his kind permission for allowing the census to be conducted on his property at Windy Point, Lake of the Woods.

Figure 1. Distribution of Piping Plovers in Ontario, 1996.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○ = 0 Birds
● = 1-10 Birds
N
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Table 1. Locations and numbers of Piping Plovers found in Ontario, 1996.

Date	Map sheet 1:50,000	Site location	Distance covered (km)	No. of adults	Habitat assessment[a]
5 June	52E/2	Big Island (LOTW)[b]	2.0	0	M
5 June	52E/2	Bigsby Island (LOTW)	1.0	0	M
5 June	52D/15	Windy Point (LOTW)	1.0	0	G
13 June	52 D/15	Windy Point (LOTW)	1.0	3	
6 June	52 D/15	Sable Islands (LOTW)	6.0	0	G
13 June	52 D/15	Sable Islands (LOTW)	6.0	0	
3 June	40 I/9	Gravelly Bay (Long Point)	3.0	0	G
6 June	40 I/9	Courtright Ridge (Long Point)	1.0	0	M
4 June	41A/9	Wasaga Beach (Lake Huron)	2.5	0	M
6 June	41N/7	Agawa Bay (Lake Superior)	5.0	0	M
6 June	41K/15	Beaver Rock (Lake Superior)	0.5	0	M
6 June	41N/2	Alona Bay (Lake Superior)	0.6	0	U
6 June	41K/15	Methany Bay (Lake Superior)	0.5	0	U
6 June	41K/15	Sawpit Bay (Lake Superior)	0.3	0	U
6 June	41K/16	Batchawana Bay (Lake Superior)	2.0	0	U
12 June	41G/10	Desert Point (Great Duck Island, Lake Huron)	2.0	0	G
12 June	41G/10	Horseshoe Bay (Great Duck Island, Lake Huron)	0.5	0	G
12 June	41G/10	Western Duck Island (Lake Huron)	2.0	0	G
17 June	41N/5	Caribou Island (Lake Superior)	5.0	0	G

[a] U= Unsuitable, M= Marginal, G= Good.

[b] LOTW= Lake of the Woods.

Table 2. Number of Piping Plovers observed at Lake of the Woods, Ontario (1929-96)[a].

Year	Sable Islands		Windy Point		Total
	(Adults)	(Young)	(Adults)	(Young)	(Adults)
1929	ND[b]	2[a]	ND	ND	ND
1938	6	ND	ND	ND	6
1974	5	ND	ND	ND	5
1978	5	ND	ND	ND	5
1979	2	ND	4	ND	6
1980	3	ND	ND	ND	3
1981	4	ND	ND	ND	4
1983	2	2	ND	ND	2
1986	6	ND	ND	ND	6
1987	5	1	5	ND	10
1988	3	3	ND	ND	3
1989	6	7	2	ND	8
1990	4	1	0	ND	4
1991	5	2	0	ND	5
1992	0	0	2	ND	2
1993	1	0	0	ND	1
1994	3	0	0	ND	3
1995	0	0	3	ND	3
1996	0	0	3	ND	3

[a] Source: 1929 specimens are in the Royal Ontario Museum; other information adapted from Heyens 1994.

[b] ND = no data were collected.

2.7 The 1996 Piping Plover census in Manitoba

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Abstract

Sixty adult Piping Plovers *Charadrius melodus* were recorded on 11 of 30 beach and alkali lake shores in Manitoba during the 1996 breeding season. Most plovers were located at two sites: Gull Bay at the north end of Lake Winnipeg and West Shoal Lake, 30 kilometres northwest of Winnipeg. High water levels in all census areas lingered late into the breeding season, possibly causing the birds to abandon some normally used nesting sites. Artificial islands, constructed near the West Shoal Lake nesting areas, were used by eight nesting pairs of plovers. Fenced areas on Lake Winnipeg public beaches protected some Piping Plover nests.

Résumé

Soixante pluviers siffleurs (*Charadrius melodus*) adultes ont été enregistrés sur 11 des 30 plages et rivages du Manitoba au cours de la saison de nidification de 1996. La plupart des pluviers ont été vus sur deux sites : la baie Gull à l'extrémité nord du lac Winnipeg et le lac West Shoal, à 30 km au nord-ouest de Winnipeg. L'eau est restée haute dans toute la région recensée jusqu'à une période avancée de la saison de nidification, ce qui a peut-être poussé certains oiseaux à abandonner des sites de nidification traditionnels. Des îles artificielles, construites près des aires de nidification du lac West Shoal, ont été utilisées par huit couples de pluviers. Les zones clôturées sur les plages publiques du lac Winnipeg ont permis de protéger plusieurs nids de pluviers siffleurs.

Introduction

The Manitoba census was conducted as part of the 1996 International Piping Plover Census. Beginning with Haig's (1987) studies in 1981, a continuous record of Piping Plovers has been maintained for some Manitoba nesting areas. Haig identified 10 breeding sites and produced a file of potential breeding sites (Haig 1986). W. Koonz continued yearly surveys of important Piping Plover nesting areas from 1987-1993 and R.E. Jones has made annual visits to these sites from 1994-1996.

The 1996 International Piping Plover Census was designed to determine the North American adult Piping Plover population. This effort included a census of winter habitats in the United States, Mexico, some Caribbean Islands, Cuba and the Bahamas and a breeding survey designed to census adult birds on nesting territories.

Methods

The 1996 Manitoba census took place from 1 to 16 June. Census methods followed the 1996 International Piping Plover Census guidelines (Plissner 1995). Manitoba Department of Natural Resources (MDNR) staff and volunteers contributed to the survey which concentrated on historically occupied sites and potential habitats as identified by Haig (1986).

The census covered about 70 km of beach shoreline in 60 hours of searching. Field equipment included 1:50,000 topographic maps, binoculars, spotting scopes and data forms. Surveys were completed on foot; boats and all-terrain vehicles (ATVs) were used to access some sites. Weather conditions were favorable, as only one survey was postponed due to rain.

Results

A total of 70 km of beach shoreline was searched by one to three observers. Thirty-one sites were examined (Fig. 1). Sixty adult Piping Plovers, including 24 pairs were recorded at 11 sites (Table 1). Most of the birds were found at two locations, Gull Bay (north and south sandspits) 17 birds, and West Shoal Lake (both sites) 26 birds. No Piping Plovers were recorded at the Oak Lake site described in 1991 (Koonz 1994).

High water characterized the conditions during and preceding the Manitoba census. The Gull Bay sandspits were iced in on the 3 June census day. Open water in Gull Bay allowed both sandspits to be visited; however much of the plover habitat was covered by huge blocks of ice. Other sites provided narrow bands of habitat, much reduced from previous years. A second survey of the Gull Bay sandspits was completed on 22 July. Seven birds were recorded on the north spit but no chicks or nests were observed. High water and ice scouring likely contributed to the nest failures.

The West Shoal Lake Piping Plover census and nesting effort was also impacted by high water as plovers concentrated on the artificial islands. Water levels had returned to near those noted by Haig (1987) but vegetation encroachment over the past 10 low water years greatly reduced the area's value for nesting. Exceptionally high water on Lake Manitoba reduced the width of breeding habitats there.

Discussion

Manitoba Piping Plover populations are declining. Haig (1987) estimated 100-120 adults from half of the presently surveyed breeding range. Koonz (1994) and Moszynski et al. (1988) recorded the following numbers of adults from 1987-1995: 89 in 1987, 120 in 1988, 103 in 1989, 130 in 1990, 80 in 1991, 77 in 1992, 64 in 1993, 113 in 1994 and 82 in 1995. The 60 adults counted in 1996 contribute to the downward trend (Table 2).

Habitat declines continue due to cottage developments, water stabilization and increased human use of suitable nesting beaches. Stabilization of water levels on Lake Manitoba and a maturation of its wooded beaches have reduced nesting areas to a single site. Planned beach front developments and increased 4-wheel drive and ATV traffic preclude re-occupancy of some former Piping Plover nesting sites on the lake.

High water levels throughout the Manitoba nesting range resulted from above normal precipitation which began in 1995 and continued through the 1996 season. Plovers were forced from traditional nesting sites into less suitable areas or to abandon nesting attempts entirely.

Piping Plovers are known to occupy emerging habitats and to abandon unsuitable traditional breeding sites. Examples of new habitats include a pair nesting in a parking lot at Oak Hammock Marsh from 1974-1976 (Gardner 1981). In 1993, (not 1994 as reported in Lyseng 1996) a pair nested on the gravel shore of the fenced-in waste water treatment lagoon 0.8 km south of the Oak Hammock Marsh Conservation Centre (Koonz 1993). Habitat loss due to shoreline stabilization has resulted in an abandonment of all but one Lake Manitoba nesting site.

Manitoba Parks Branch and the Manitoba Plover Guardians worked on site to manage Piping Plovers nesting at provincial park sites, particularly in Grand Beach Provincial Park where people and Piping Plovers compete for space. Fences, information signs and assigning people to protect and interpret nests was effective. Three park nests were fenced in 1996.

Considerable effort has gone into enhancing Piping Plover habitat in the West Shoal Lake and Gull Bay sandspit areas. Problems noted at West Shoal Lake include strong wind tides and trampling by horses and cattle. Gull Bay plovers were competing with the activities of commercial fishermen who camp on the sandspits during the summer fishing season.

Three islands were constructed to reduce the wind tide problem on West Shoal Lake. These islands were high enough for plovers to escape the high water. They were constructed in varying shapes and sizes during the winters of 1992 (Koonz 1993), 1993 (W. Koonz, pers. comm.) and 1995 (Jones and Koonz 1997). Plover activity has been monitored on the islands and adjoining mainland habitats annually (Table 3). All Piping Plover nesting at the south end of the lake was on artificial islands in 1996. Both islands there have been naturally vegetated by foxtail barley (*Hordeum jubatum*), lamb's quarters (*Chenopodium sp.*) and burning bush (*Kochia scoparia*). Annual vegetation monitoring and, if necessary, vegetation management will be done to assure that plover nesting habitat remains.

Both West Shoal Lake nesting areas were fenced to exclude cattle and horses. High water in 1996 forced plovers not using artificial islands to nest outside the fenced areas.

At Gull Bay, the plover/fishermen competition was reduced by an agreement in 1994 between the Grand Rapids Cooperative Fishermen Association and the MDNR. The north sandspit was declared "The Walter C. Cook Special Conservation Area". The spit's south half was fenced to prevent ATV and other heavy use during the Piping Plover nesting season. The remainder of the spit is used by fishermen for their purposes. Over 50% of the Gull Bay plover nests have been in the protected area (1994-1996). Ice and high water damage area fencing annually.

Acknowledgements

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Figure 1. Location of sites censused in Manitoba during the 1996 International Piping Plover Census (adapted from Plissner and Haig 1997).

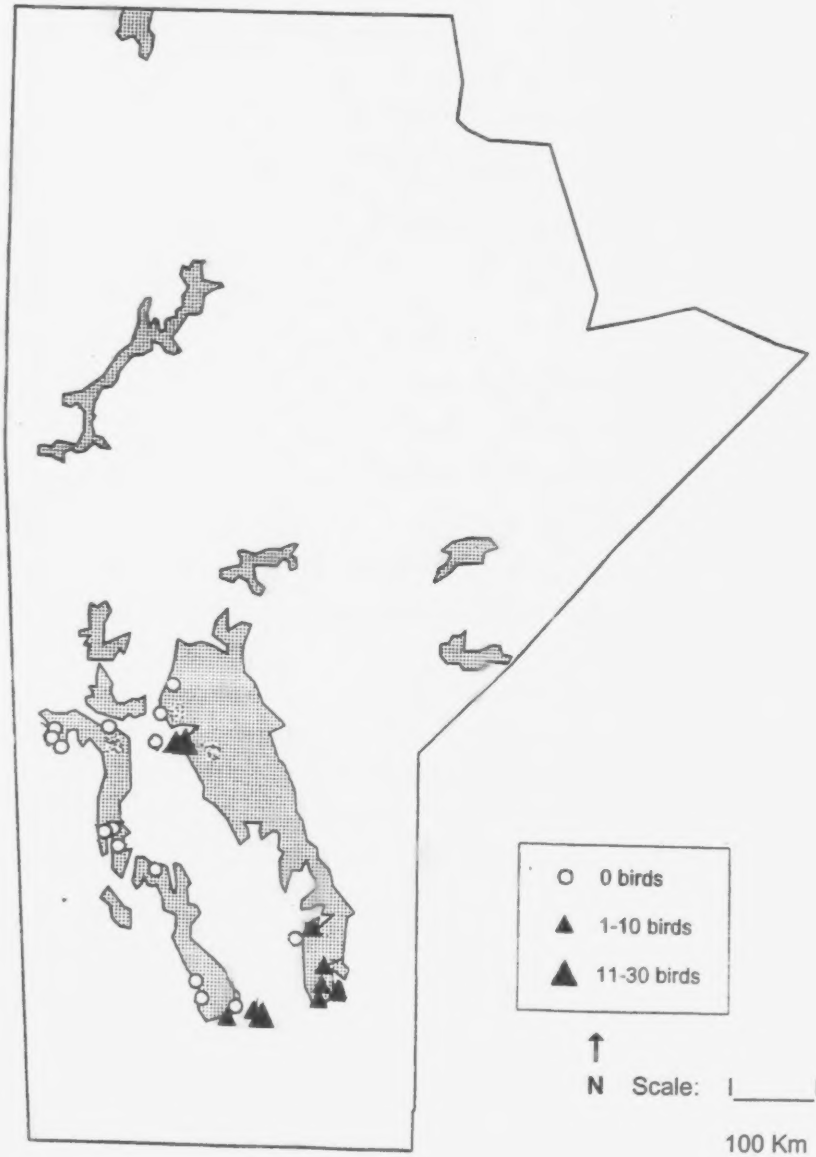
○ 0 birds
▲ 1-10 birds
▲ 11-30 birds
N
Scale:
100 Km

Table 1. Locations and numbers of Piping Plovers recorded in Manitoba in 1996.

Site	Lat-Long	Map name	Date	Adults	Pairs
West Shoal Lake "South"	50°19′ N, 97°41′ W	62 I/5	14 June	8	2
West Shoal Lake "West"	50°17′ N, 97°39′ W	62 I/5	6 June	18	8
Hecla Island "Sand Spit"	51°00′ N, 96°51′ W	62 B/2	13 June	2	1
Patricia Beach Prov. Park	50°25′ N, 96°36′ W	62 I/7	13 June	3	1
Grand Beach "East"	50°34′ N, 96°36′ W	62 I/10	6 June	1	0
Grand Beach "West"	50°33′ N, 96°37′ W	62 I/10	6 June	4	2
Grand Marias beach	50°33′ N, 96°37′ W	62 I/10	6 June	2	1
Elk Island	50°45′ N, 96°32′ W	62 I/10	16 June	2	1
Clandeboye Bay	50°15′ N, 98°05′ W	62 J/8	11 June	3	1
Twin Lakes Beach, Delta	50°20′ N, 97°08′ W	62 J/8	7 June	0	0
"Stony Beach", Delta	50°11′ N, 98°12′ W	62 J/8	1 June	0	0
Big Point, L. Manitoba	50°24′ N, 98°31′ W	62 J/7	16 June	0	0
"Hollywood Beach"	50°33′ N, 98°37′ W	62 J/10	16 June	0	0
Big Sandy Point	50°46′ N, 98°44′ W	62 J/15	16 June	0	0
"Riverton Sandy Bar"	50°59′ N, 96°54′ W	62 I/15	13 June	0	0
Whitefish Point	52°57′ N, 100°58′ W	63 C/15	10 June	0	0
"Salt Flats", Hwy 10	53°01′ N, 100°06′ W	62 F/3	10 June	0	0
Salt Point "North"	52°48′ N, 100°51′ W	62 C/15	10 June	0	0
Salt Point "South"	52°47′ N, 100°51′ W	62 C/15	10 June	0	0
Smith Point	52°53′ N, 101°00′ W	63 C/14	10 June	0	0
Camperville beach	51°59′ N, 100°08′ W	62 N/16	11 June	0	0
Bluff Point	52°25′ N, 100°58′ W	62 N/15	11 June	0	0
Robinson Bay	51°51′ N, 99°54′ W	62 O/13	11 June	0	0

Table 1. (continued)

Site	Lat-Long	Map name	Date	Adults	Pairs
Red Deer Point	52°01′ N, 100°00′ W	62 O/13	11 June	0	0
Katimik Lake	52°52′ N, 99°21′ W	63 B/14	5 June	0	0
Grand Rapids airport	53°09′ N, 99°18′ W	63 G/5	4 June	0	0
Grand Rapids genr. stn.	53°09′ N, 99°17′ W	63 G/5	4 June	0	0
Sturgeon Gill landing	53°27′ N, 99°05′ W	63 G/6	3 June	0	0
Gull Bay, "North Spit"	52°55′ N, 98°50′ W	62 B/15	3 June	15	6
Gull Bay, "South Spit"	52°52′ N, 98°53′ W	62 B/16	3 June	2	1
Oak Lake[a]	49°40′ N, 100°45′ W	62 F/10	24 May	0	0
Totals				60	24

[a] Surveyed prior to Manitoba census dates.

Table 2. Comparison of 1991 and 1996 Piping Plover population counts.

Site	1991 census		1996 census	
	No. of adults	**No. of pairs**	**No. of adults**	**No. of pairs**
West Shoal Lake "South"			8	2
West Shoal Lake "West"	13	6	18	8
Hecla Island "Sand Spit"	2	1	2	1
Patricia Beach Prov. Park	2	1	3	1
Grand Beach "West"	2	1	4	2
Grand Beach "East"			1	0
Grand Marias beach	9	4	2	1
Elk Island	2	1	2	1
Clandeboye Bay	3	1	3	1
"Riverton Sandy Bar"[a]	2	1	0	0
Willow Island	2	1		
Victoria Beach	1	0		
Gull Bay, "North Spit"	15	7	15	6
Gull Bay, "South Spit "	23	11	2	1
Oak Lake[b]	4	2	0	0
Totals	80	37	60	24

[a] Also referred to as "Riverton Island" (see Koonz 1994)

[b] Surveyed prior to Manitoba census dates.

Table 3. Number of Piping Plover nests found on islands constructed in West Shoal Lake.

Years checked	Island #1[a]	Island #2[b]	Island #3[c]
1993	0		
1994	1[d]	0	
1995	5	0	
1996	6[e]	2	0

[a] Built in 1992.
[b] Built in 1993.
[c] Built in 1995.
[d] Two American Avocets (*Recurvirostra Americana)* nests also found.
[e] Additionally, 16 American Avocet nests found.

2.8 The 1996 Piping Plover census in Saskatchewan

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Abstract

The 1996 census of Piping Plovers in Saskatchewan was conducted in a similar manner to the 1991 census to monitor the population trend of this endangered species. Shorelines of 276 water bodies were surveyed, the majority between 1 and 16 June. Although this is less than the 486 water bodies surveyed in 1991, the results are comparable because many sites surveyed in 1991 had no suitable habitat and thus were not surveyed in 1996. The 1996 census included sites where plovers had occurred in 1991, sites identified in 1991 and succeeding years as having potential habitat, and a sample of small basins of unknown potential. As in 1991, we estimate that 95% of the total known plover habitat was censused.

The total count for Saskatchewan was 1348 adult Piping Plovers, including at least 534 breeding pairs. This represents a 15% increase over the 1172 adults (481 pairs) counted in 1991. Two small basins with plovers were not surveyed in both 1991 and 1996. If these basins are deleted to enhance comparability, the comparison becomes 1170 birds in 1991 versus 1333 birds in 1996, representing a 14% increase. Plovers were found at 69 sites, with one or more pairs found at 51 of these. Concentrations of birds were more pronounced than in 1991. In 1996, three sites accounted for 764 Piping Plovers, or 56% of the provincial total, whereas in 1991 four sites accounted for 56% of the population. The three main sites in 1996 were Big Quill Lake, Chaplin Lake, and Willow Bunch Lake (see below). The number of

Piping Plovers in Saskatchewan in 1996 accounted for 24.4% of the total North American population, slightly more than the 21.4% in 1991.

The increase in population in Saskatchewan may be due to an influx of plovers from elsewhere on the prairies. On the Great Plains of the U.S., numbers decreased from 2030 birds in 1991 to 1339 in 1996 (J. Plissner, pers. comm.). High water and flooding reduced plover habitat along the Platte and Missouri rivers in the U.S., and may have caused birds to continue northward to Saskatchewan. Alternatively, there may have also been a small real increase in population in Saskatchewan.

Several factors threaten Piping Plover habitat. Natural changes in water level over time continue to have the greatest impact. Drought was an important threat to habitat in the years prior to 1991. However, heavy precipitation and run-off since 1991 caused flooding of many beaches in 1996. Although trampling of beaches by cattle continues to threaten habitat at a few locations, in 1993 and 1994 cattle were fenced from beaches at four basins of high use. Fencing, along with habitat enhancement through pumping water onto dry areas, also occurred at Big Quill Lake. At Lake Diefenbaker, water level increases during breeding continue to be a threat.

Résumé

Le recensement des pluviers siffleurs de 1996 en Saskatchewan a été effectué de façon similaire au recensement de 1991 afin de mettre en relief les tendances démographiques de cette espèce en danger. Les berges de 276 cours des d'eau et lacs ont été explorées, principalement entre le 1er et le 16 juin. Bien que le recensement de 1991 ait porté sur 486 cours d'eau et lacs, les résultats restent comparables parce que de nombreux sites répertoriés en 1991 ne recelaient en fait aucun habitat approprié et n'ont donc pas été explorés en 1996. Le recensement de 1996 comprenaient tous les sites où des pluviers avaient été observés en 1991, les sites identifiés en 1991 et au cours des années suivantes comme possédant des habitats appropriés, et quelques basins dont le potentiel était inconnu. Comme en 1991, nous estimons que 95 % des habitats de pluviers ont été répertoriés.

Introduction

Piping Plover censuses in Saskatchewan previous to the 1991 International Piping Plover Census addressed only part of the species' range in any one year (Harris et al. 1985, 1987; Weidl 1986,`1994; Harris 1988a,b,c; Purdy and Weichel 1988; Harris and Lamont 1989, 1990, 1991; Johnson and Seguin 1989; Hjertaas 1991). The 1991 census gave us our first complete survey of the Piping Plover population (Haig and Plissner 1992; Skeel 1991, 1993, 1994). At that time, an extensive effort was made to identify Piping Plover basins throughout the province; 486 water bodies were censused in 1991, including all known sites with records of Piping Plovers, sites identified as having potential plover habitat, and sites of unknown potential (many of which proved to be unsuitable).

The 1996 International Piping Plover Census was the second complete census of Piping Plovers in Saskatchewan. A comparison of the 1996 and 1991 census results provides the first good insight into the provincial (and continental) population trend, the degree to which population changes at individual sites are due to movement, and whether this reflects real population change. This paper details the findings of the census in Saskatchewan, compares the 1996 survey with the 1991 results, and outlines habitat threats and conservation activities at sites with Piping Plovers.

Methods

Selection of sites

Site locations were primarily determined on the basis of known or potential use by Piping Plovers as identified in the 1991 International Piping Plover Census. Sites visited in 1996 included: (1) those with Piping Plovers in 1991; (2) sites with no plovers in 1991 but identified at that time as having potential habitat; (3) three sites not visited in 1991 but identified since then as having Piping Plovers; and (4) 16 sites of unknown potential that were not visited in 1991.

As in 1991, the census work was divided into three categories: high-priority basins, low-priority basins, and small water bodies in the Missouri Coteau. In addition, one Piping Plover was reported from each of two sites that do not usually support plovers. In total, 276 sites were censused.

High-priority sites

High-priority sites included 70 wetlands that had Piping Plovers in 1991, three wetlands not visited in 1991 but identified in 1995 as having plovers (north and south basins of Freshwater Lake, and Wells Lake), and one wetland with plovers in 1995 but not in 1991 (Opuntia Lake). Of the 71 sites with Piping Plovers in 1991 (Table 1; Skeel 1991, 1993, 1994), two small basins located in the Missouri Coteau were not censused. One was not censused because it was identified from the air as having no habitat (72J1: Universal Transverse Mercator [UTM] 170 394; see below), and the other basin had habitat but was not done due to circumstances (Skyeta Lake; one pair in 1991). Thus out of the total of 74 high-priority basins, 73 were censused. High-priority basins were censused by biologists from Saskatchewan Environment and Resource Management (SERM), Saskatchewan Wetland Conservation Corporation (SWCC), and Canadian Wildlife Service (CWS), or the surveys were tendered out to consulting biologists on a contract basis.

Low-priority sites

Low-priority basins included 88 wetlands that had no Piping Plovers in 1991 but were identified at that time as having potential plover habitat (excluding Opuntia Lake; see above), 16 wetlands of unknown potential that were not checked in 1991, and three wetlands identified in 1991 as having no potential habitat. Of the 223 sites identified in 1991 as having potential habitat (Table 2; Skeel 1991), 134 were not censused: 91 of these were small basins located in the Missouri Coteau that were identified from the air as having no habitat (see below), and 42 were not censused for various reasons (preliminary checks indicated no habitat in 1996; they were judged as unlikely to have habitat based on 1991 comments; or the sites were outside the Piping Plover's usual range). Thirteen of the 16 wetlands of unknown potential lay along the northern edge of the plover's range; none of these had plovers in 1996.

A total of 107 low-priority basins were censused by biologists from SERM and volunteers, many of whom were skilled bird-watchers.

Missouri Coteau

The hundreds of small basins in the Missouri Coteau which did not have plovers in 1991 were treated separately because it was impractical to census each one on the ground. Nine of ten larger basins in the Coteau were included as high-priority basins, and one as a low-priority basin.

It could not be assumed that the same basins would be suitable as were identified in 1991 because water levels were considerably higher in 1996 than in 1991. In order to identify suitable wetlands, an aerial survey of the entire Coteau from near the Trans Canada highway to the U.S. border was conducted from a small fixed-wind aircraft on 16 and 18-20 May 1996. The pilot flew over all basins that had Piping Plovers or habitat in 1991, as well as all basins larger than 40 ha and hundreds of smaller basins. An observer(s) marked basins that appeared to have water and sand or gravel beaches directly onto 1:50,000 topographical maps. The Coteau includes sites on map sheets 62E/4; 72G8,9,16; 72H/1-8,11-14; 72I/4; and 72J/1.

A total of 123 small basins were identified as having potential habitat, of which 27 had supported Piping Plovers in 1991 and thus were categorized as high-priority. The remaining 96 basins were grouped and assigned to teams of censusers. All but two basins (UTMs 740 187 and 740 181) near Skyeta Lake were censused. Censusers included biologists from SERM, SWCC, CWS and Ducks Unlimited.

All sites are identified by UTM grid number (Tables 1 and 2; UTM is from the first map sheet listed). Site names are taken from 1:50,000 topographical maps or, in a few cases, are local names.

Censusing of sites

Censuses were conducted on 31 May to 29 June with the majority, including all high-priority sites, censused within the preferred time period 1-16 June. Two sites were censused on 31 May, and 11 sites after 16 June (of which one northern site, Russell Lake, had Piping Plovers).

All suitable habitat was censused at all but four of the 73 high-priority sites. At Big Quill Lake, it was estimated that 90% of the expansive habitat was censused, including all areas with the best habitat. At Lake Diefenbaker, about 91% of the habitat was censused; sections of shoreline along western parts of the lake, which usually support few plovers, were missed due to poor weather. At the remaining two sites, 60% of the habitat was covered at Ingebright Lake (the same area as censused in 1991) and 96% at a small unnamed basin. At low-priority sites and small basins in the Missouri Coteau, coverage was 100% at all sites rated as good habitat (with the exception of one site north of the plover's normal range). At all but 7 sites rated as marginal habitat, 90-100% of suitable habitat was censused. Overall, coverage was comparable to that in 1991.

Censusers followed procedures set out in the guidelines for the 1996 International Piping Plover Breeding Census, and recorded information for each site on the Individual Census Report. A request was added to each census report to describe any threats to the security of the habitat to the Piping Plover, and rate the threat as light, moderate, or extensive.

All censusers received a handout outlining methodology and, in most cases, the same 1:50,000 maps that were used in the 1991 census. For many of the basins, beach areas had been outlined on the maps, substrate noted, and all sightings of Piping Plovers had been marked in 1991. Censusers were thus able to make more efficient use of time in ensuring all habitat was covered.

For each site censusers mapped all observations of breeding pairs, single adults with nests, and unpaired adults. Number of adults recorded was defined as the actual number of individual birds observed. Number of pairs recorded was defined as the number of territorial pairs (presumed mated) plus single adults with a nest or young.

In most cases, nests were not intentionally located in order to minimize disturbance. At Big Quill Lake, however, nests were located to reduce confusion and double counting. Observers spent no more than five minutes in any one Piping Plover territory, although this may have occasionally been exceeded at sites where plover densities were high. Censuses were conducted throughout the day, but were not conducted in extreme weather conditions, including very hot, cold, or rainy weather.

Most censuses were conducted by systematically walking suitable beaches on foot. At some larger basins, including Big Quill Lake, Chaplin Lake, the arms of Lake Diefenbaker, and Willow Bunch Lake, some areas were censused by slowly traversing the habitat with an all-terrain vehicle. Four areas (Last Mountain Lake, the portion of Lake Diefenbaker west of Riverhurst, and the South Saskatchewan River surveys upstream of Saskatchewan Landing and between the Gardiner Dam and Saskatoon) were conducted using a boat or other small water craft to access suitable beaches.

Of the over 100 censusers, about one-third had participated in the 1991 census, and many visited the same basins as in 1991. About half of the censusers were volunteers, most of whom are members of local natural history societies.

Censusers were specifically requested to look for leg bands on birds because several hundred chicks were banded and colour-coded to location at four major nesting basins in 1995 in anticipation of the 1996 census. The number banded at various locations included: 235 chicks at Big Quill Lake, 56 chicks at Manitouu Lake, and 54 chicks at Chaplin Lake. All banded chicks at Lake Diefenbaker were presumed to have died before fledging due to flooding of the reservoir. In addition, many adults and young have been banded in years previous to 1995.

Results

The total count of Piping Plovers for Saskatchewan in 1996 was 1348 adult birds, including at least 534 breeding pairs. Plovers were counted at only 69 of the 276 water bodies censused with the number of birds at each ranging from 1 to a high of 435 at Big Quill Lake (Table 1). The number of pairs ranged from 0 to 196. All but 18 of the 69 basins had at least one pair, indicating potential breeding at 51 basins.

Piping Plovers were distributed across the southern third of Saskatchewan with notable concentrations at Big Quill Lake, Chaplin Lake, and in the south portion of the Missouri Coteau (Fig. 1). These three areas had, respectively, 32%, 15% and 21% of the provincial population. Smaller clusters occurred in the northwest and in the east portion of Lake Diefenbaker.

Three sites had very high concentrations of Piping Plovers: Big Quill Lake had 435 birds, Chaplin Lake had 205 birds, and Willow Bunch Lake had 124 birds. These sites accounted for 764 plovers, or 56% of the Saskatchewan population. High numbers also occurred at Lake Diefenbaker (75 birds), Manitou Lake (63 birds) and Fife Lake (53 birds). The 41 basins of the Missouri Coteau with plovers, excluding Chaplin, Willow Bunch, and Fife lakes, yielded a total of 101 birds.

Slightly more than half the basins with plovers in 1996 also had plovers on the 1991 count (Table 2). Out of the total of 69 sites with plovers in 1996, and 71 sites with plovers in 1991, only 35 sites had plovers in both years. Change in basin use largely occurred in the smaller basins or where smaller populations occurred. Of the 23 basins where at least 10 plovers were counted in one of the years, 17 basins (74%) also had plovers in the other year.

Overall, the provincial population in 1996 (1348 plovers) was 15.0% higher than the population in 1991 (1172 plovers). Substantial changes, both increases and decreases, in population size occurred at several locations between 1991 and 1996. At Big Quill, Chaplin and Willow Bunch lakes population size increased dramatically, whereas numbers declined at Lake Diefenbaker and Manitou lakes.

A total of 207 sites had no Piping Plovers in 1996 (Table 3; 7 sites are north of the plover's usual range). Most of these sites had been judged in 1991 to have habitat or potential for habitat. Sixteen of these sites were not censused in 1991, but only two of these (the two basins of Freshwater Lake) had habitat in 1996; most of the remainder were flooded and it was difficult to judge if suitable habitat might exist at lower water. At 91% (all but 19) of the 207 sites where no plovers were found, the habitat was rated as marginal or unsuitable, in most cases due to high water reducing or eliminating beaches. Of these 207 sites, 34 had Piping Plovers in 1991, six of these supporting more than 10 plovers in that year, with a high of 28 birds at Little Manitou Lake.

We feel confident that only a small number of plovers may have been missed on this census. At 94% of the sites with habitat, all or almost all (90-100%) of the habitat was censused. At sites where Piping Plovers were found, close to 100% of the habitat was censused at all but two locations. (A third location, Kipling Marsh where one plover was seen, does not normally support plovers and it is unlikely other plovers were present.) At Lake Diefenbaker, a segment in the west portion of the reservoir (which supports few plovers) was missed due to poor weather. The reservoir east of the Riverhurst Ferry area, where all but three of the plovers were counted, was completely censused. Thus it is unlikely many, if any, plovers were missed at Lake Diefenbaker. At Big Quill Lake, which had the highest number of plovers in North America in 1996, it was estimated that 90% of the habitat was covered, including all areas with the best habitat. Because it is an enormous lake, covering approximately 380 km^2 with about 200 km of shoreline when full, it is likely some plovers were missed. Although difficult to estimate the number missed at Big Quill Lake, it was probably less than 43 birds (10% of the total count). A few plovers may also have been missed at three small basins with habitat located together in the Missouri Coteau (Skyeta Lake and UTMs 740 187 and 740 181) that were not censused. These three basins also had habitat in 1991 and together supported only one pair.

The effort involved in censusing sites with habitat or potential habitat in 1996 (276 sites) is similar to that of the 1991 census (294 sites with plovers or potential habitat; 13 of these were not visited in 1996 because they were identified as unlikely to have habitat). Overall, more basins were visited in 1991 (486 sites), but the habitat potential of many was unknown and a high proportion (192 sites) proved to have no potential for plovers. In both years, virtually all available habitat was censused. In 1996, a total of 2173.7 km of habitat was censused with only about 95.1 km (4.2%) missed. At sites where Piping Plovers were found (a total of 1258.3 km censused), only about 40.3 km (3.1%) of habitat was missed. Any habitat missed was usually of lower quality. Only two sites, the north and south basins of Freshwater Lake (near Manitou Lake), were not censused in 1991 that have since been found to have good Piping Plover habitat (15 birds in a 1995 partial survey).

The 1996 population count can be compared to the 1991 count with a high degree of accuracy. The effort was similar both years, as was the coverage of suitable habitat. Only a very few areas were not censused in 1991 that were subsequently discovered to have habitat (only Freshwater Lake with records of plovers, representing 15 birds), and only a very few areas with habitat were missed in 1996 (only Skyeta Lake with records of plovers, representing two birds in 1991). Taking these sites that were not censused into consideration, the 1991 adjusted total of 1170 birds (excluding two birds at Skyeta Lake from 1172 birds) and the 1996 adjusted total of 1333 birds (excluding 15 birds at Freshwater Lake from 1348 birds) yields an increase of 13.9%.

Discussion

Saskatchewan's count of 1348 Piping Plovers (534 pairs) comprises 24.4% of the total North American count of 5532 plovers (2478 pairs). This is a slightly greater proportion than the 21.4% found in 1991 (Haig and Plissner 1992). The largest breeding population of any basin in North America was found at Big Quill Lake, which attracted 7.9% of the continental population (25.8% of the Canadian Prairie population). In 1991, Big Quill Lake ranked 6th with 2.8% of the continental population, and Lake Diefenbaker ranked first with 5.1% of the population. Chaplin Lake had 3.7% of the population (12.2% of the Canadian Prairie population) in 1996, Willow Bunch Lake had 2.2% (7.4% of the Canadian Prairie population), and Lake Diefenbaker had only 1.4% (4.8% of the Canadian Prairie population).

The 1996 census is only the second time that concurrent surveys of all potential wetlands in the province have been conducted (the 1991 census was the first). The wide fluctuations in number at both small and large sites, with only a small provincial population change, suggests that fluctuations at any individual site may reflect more a movement from one basin to another, than an overall population change. Although the provincial population increased by only 15%, increases at the three most populated sites were far greater: 263%, 45%, and 300% at Big Quill, Chaplin, and Willow Bunch lakes, respectively. A decrease of 77% occurred at Lake Diefenbaker, the basin with the most plovers in 1991. Hence, monitoring of population levels at selected sites is not an accurate indicator of overall population change.

The fluctuation in plover numbers at sites appears to be in response to changing habitat availability. Habitat changes result from dynamic interactions of water levels and vegetative growth over time. After a drought and subsequent loss of suitable habitat from 1984 to 1990, annual precipitation over the plover's range in Saskatchewan since 1991 has been higher than normal in every year but one (Skeel et al. 1996). Water levels have risen, and in May 1996, the number of ponds counted over the southern half of Saskatchewan was at its highest level in 21 years (United States Fish and Wildlife Service and Canadian Wildlife Service 1966). The dramatically increased the water level at most sites in 1996 caused many sites to become less attractive or unsuitable for plovers due to a loss or narrowing of beaches. Other sites, most importantly Big Quill Lake, offered more suitable habitat due to the occurrence of water in parts of the lake that had been dry for several years. The high water at many sites in 1996 may ultimately enhance beaches in future years by reducing vegetation that has been encroaching over the years of lower water.

Provincial estimates of plovers previous to the two international censuses ranged from a high of 2000-2500 plovers in 1984, to a low of 500 plovers in 1988 (Goossen 1990). The accuracy of these estimates, which were based on a few site-specific surveys, is questionable in view of our knowledge gained from the 1991 and 1996 censuses that fluctuations at a site may reflect more a movement from one basin to another, than overall population change.

An influx of plovers from elsewhere on the prairies may have been a major factor in the increase in population in Saskatchewan from 1991 (1172 birds) to 1996 (1348 birds). Plover numbers on the Great Plains of the U.S. decreased from 2030 birds in 1991 to 1339 birds in 1996 (J. Plissner, pers. comm.). This decrease is largely attributed to high water and flooding of much of the plover's habitat along the Platte and Missouri rivers. It is possible that many birds that would normally have nested there continued on to Saskatchewan. Alternatively, there may have been a real increase in the plover population in Saskatchewan, although this increase would be overshadowed by the overall decrease in plovers on the Great Plains and Prairies where overall numbers went from 3467 in 1991 to 3026 in 1996.

Regional patterns

Quill Lakes

Although Big Quill Lake has consistently supported high numbers Piping Plovers since annual counts began in 1984, dramatic fluctuations in numbers characterize the population. Counts range from 43 in 1989 (Harris and Lamont 1989), and 211 in 1993 (Harris 1993a), to peaks of >440 in 1995 (estimated; W.C. Harris, pers. comm.) and 435 in 1996. This represents a ten-fold increase over a six-year period. Although use around the entire shoreline has been documented, densities were highest along the entire west and east sides and lowest at the north tip and along the south shore in 1991 and 1996. This lake is also a main staging area for plovers, with major staging areas occurring along shores of the south, southwest, and north tip (Harris 1993b, 1994, 1995).

Changes in water level at Big Quill Lake over the last 10 years has resulted in changing habitat conditions and a wide fluctuation in use by plovers. Because this large saline lake is shallow, small changes in water level have a dramatic affect over large areas. Water level reached a 30-year low in 1993, recovering with an increase of 1.15 m by 1995, and a further 0.1 m increase in 1996 (Saskatchewan Water Corporation; currently Saskatchewan Watershed Authority). In 1989 it was estimated that less than 25% of the basin contained water (Harris and Lamont 1989). Plover numbers plummeted in 1989 as distances between traditional nesting beaches and the water line increased to 1-10 km. However, numbers began increasing in 1990 as gravel beaches closer to the existing water line began supporting some nesting plovers as a result of vegetative growth on these previously barren sites (Harris and Lamont 1990). With increasing water levels from 1994 to 1996 due to higher annual precipitation and spring run-off, the average distance on nesting beaches from vegetation to water was reduced to about 1 km in 1993 and 1994, and to less than 200 m in 1995 (Harris 1995) and 1996. In 1995 and 1996 the dramatic rise in water level caused nesting plovers to become more concentrated as available habitat decreased. Piping Plover numbers have steadily increased since 1990 as a result of decreasing distances from nesting beaches to water.

Over the last decade, low water level resulting in great distances from nesting beaches to shorelines, has been the greatest "threat" to Piping Plover habitat and, hence, to plover numbers and productivity at Big Quill Lake. Vegetative encroachment on traditional nesting areas also threatens habitat after extended periods of low water. However, if the current trend of rising water continues such that beaches are flooded, high water level will threaten habitat as availability diminishes. Changing water regimes are a necessary component of plover habitat, as high water levels are necessary to regularly flood and maintain beaches from extensive vegetative encroachment.

At Little Quill Lake, separated from Big Quill Lake by small Mud (Middle Quill) Lake, plover numbers also fluctuate with the water regime. A low count of 0 birds occurred in 1996 when all beaches were flooded. Previous counts have varied from seven and five birds in 1984 and 1989, respectively (Harris et al. 1985; D. Hjertaas, pers. comm.), to 13 birds in 1991 and a high of 39 birds in 1993 (D. Duncan). Breeding records occur at five areas around the basin.

Chaplin Lake

The 1996 census at Chaplin Lake, another site which consistently attracts substantial numbers of Piping Plovers, was the first complete census since 1991. The 205 plovers in 1996 is the highest count since the first survey in 1984, when 253 birds were counted over 48% of the 248.7 km shoreline (Harris et al. 1985). Additional surveys yielded 57 and 17 plovers in 1987 and 1988, respectively, when most of the lake was dry (Harris et al. 1987, Harris 1988a), and 66 plovers in 1990, when water levels were very low in all four basins (Harris and Lamont 1990). Progressive increases in water levels in 1991 and 1996 were accompanied by increases in plovers to 113 birds (Harris and Lamont 1991) and 205 birds, respectively.

The shorelines, and subsequently plover use, of the four basins of this large, shallow saline lake change dramatically with changes in water level. The west basin and Midtskogen Bay have, over the years, supported Piping Plovers around their entire shores. The west basin has consistently had water and a high proportion of the plovers in surveys since 1984. Although Midtskogen Bay supported concentrations of plovers previous to 1991, available habitat was reduced in 1991 and eliminated in 1996 by higher water. The east basin has supported varying numbers of plovers with records of plover occurrence along its north and east shores, and along the central third of its west shore. Most records for the south basin are from 1984, when plovers used parts of all but the southern third of the basin. The south basin has had little habitat since 1984: it was completely dry in 1987, mostly vegetated in 1990, and had no exposed beaches due to vegetation encroachment and higher water in 1991 and flooding in 1996. Flooding and high water reduce vegetation encroachment, renewing plover habitat when water levels recede.

Missouri Coteau (excluding Chaplin Lake)

The Missouri Coteau, with its hundreds of basins of varying size, is an area of importance to Piping Plovers. In 1996, 278 plovers were counted scattered over 43 basins (30 basins with at least one pair), less than the 345 plovers in 1991 counted over 39 basins (28 basins with at least one pair). Including the 205 plovers at Chaplin Lake, the total count of 483 birds throughout the Coteau comprises 36% of the Saskatchewan population (in 1991 the total of 458 comprised 39%).

Although some larger basins with gravelly shores have consistent use, at most basins use by plovers changes quite dramatically from year to year in response to precipitation and vegetative growth. Of the 59 basins that were used in at least one year of 1991 and 1996, only 21 basins (36%) were used in both years. In 1991, when water levels were just beginning to rise after the drought of the late 1980s, there were more basins identified as having habitat (131 basins; Skeel 1991) than in 1996 (93 basins) when water levels were considerably higher and many basins were flooded. (The number of basins with habitat was determined using the number identified on the May aerial flight minus those found to have no habitat when ground checked in June.) The fewer basins with suitable habitat in 1996 may account for the greater concentration of plovers that occurred at a few of the larger basins on the Coteau.

Willow Bunch Lake, a long, narrow lake with rocky and gravelly beaches rimmed by high steep banks, had an unusually high count of 124 birds (the third highest count in Saskatchewan). Birds were distributed along the entire length of the lake, excluding the ends. The two previous counts at this lake found only 31 birds in 1991, and seven birds in a census of 47% of the shore in 1984 (Harris et al. 1985).

Counts of over 20 birds occurred at seven other basins, of varying size and history of previous use. Fife Lake, a large wide lake that consistently supports plovers, had the second highest count on the Missouri Coteau with 53 birds. Most birds were distributed along the north and east rocky and gravelly shores. Previous counts vary from seven birds in 1986 (W. Harris, pers. comm.) to 29 birds in 1991. The plover counts at Big Muddy Lake, a large narrow lake, were similar at 26 (1991) and 34 (1996) birds. Plover habitat at this site is largely restricted to points along the eastern two-thirds. Although Sandoff Lake, a small alkali basin, had counts of 25 and 28 birds in 1991 and 1996, respectively, numbers were lower in the intervening years at eight (1993; D. Hjertaas, pers. comm.) and 10 birds (1994; D. Duncan). East Coteau Lake, a medium-sized saline basin, has consistently had 20-25 birds in 1991 and 1993-1996. Alkali Lake (the Canadian portion of this basin's convoluted shoreline) had a high count of 22 birds after counts of 0 birds in 1991 and three in 1994 (D. Duncan). A small unnamed basin (UTM 540 279) near the northeast arm of Lake of the Rivers has wide gravelly beaches and supported >10 plovers in both census years (11 in 1991 and 22 in 1996), as did Frederick Lake (12 in 1991 and 22 in 1996).

A sharp drop in plover numbers occurred at Old Wives Lake since 1991 when 42 birds were counted. In 1993 and 1994, 12 (D. Hjertaas, pers. comm.) and 27 (D. Duncan) were counted, respectively, in partial shoreline surveys, and only eight in 1996, most in small gravel areas near seepage along the south or southeast shore. Water levels have become progressively higher since 1991, although the basin remains below historical high levels. Several other basins experienced dramatic drops in plover numbers from 1991 to 1996, most notably Channel Lake (from 19 to 0 birds).

Trampling of beaches by cattle was identified as the primary threat to plover habitat in the Missouri Coteau. Ten sites with plovers were identified as having a moderate to extensive threat from cattle, including two sites with >10 plovers (Big Muddy and Burn lakes). The threat to habitat by cattle was identified as light at a further eight sites with >10 plovers, including at Willow Bunch Lake. Natural drought, a cause of reduced habitat availability in 1991, was not a consideration in 1996. Rather, high water contributed to less habitat being available in 1996.

Lake Diefenbaker

The number of plovers at Lake Diefenbaker has been in decline since the 1991 high count of 276 birds, when the highest concentration of plovers in North America occurred here. A 1994 survey of most of the suitable habitat and the 1996 count yielded only 88 (D. Hjertaas, pers. comm.) and 75 birds, respectively. In 1996, the high water level in the reservoir early in the spring when birds were arriving resulted in greatly reduced beach areas compared to 1991, and likely is the cause for the drop in numbers.

The highest concentration of plovers consistently occurs east of the Riverhurst Ferry. West of that point suitable habitat occurs at only a few small areas (eight areas in 1991, one in 1996). In six surveys of the Thompson and Gordon McKenzie arms between 1984 and 1991, counts varied from a low of 0 in 1986 (28 June census, water level high) to the 1991 high of 223 birds (Skeel 1991, 1994). In subsequent years, counts have yielded 102 adults in 1992 (Wait 1992), 68 adults in a partial survey in 1993 (Espie et al. 1994; three sites encompassing <1.5 km in total), 42 adults in 1994 (D. Hjertaas, pers. comm.; a nearly complete survey), 48 adults in a partial survey in 1995 (McAdam 1995; 5 sites), and 45 adults in 1996.

The segment of the lake from Palliser Regional Park and Riverhurst Ferry to the arms supports most of the remaining Piping Plovers on the lake. Counts have varied from 50 birds in 1984 (partial survey; Harris et al. 1985), to 0 birds in 1986 (W. Harris, pers. comm.), and include 22 birds in 1988 (Harris 1988b), approximately 41 birds in 1991, 38 birds in 1992 (Wait 1992), 46 birds in 1994 (D. Hjertaas, pers. comm.), and 27 birds in 1996. West of Palliser Park the remaining two-thirds of the body of the lake supports few plovers at scattered locations: approximately 12 in 1991, and only three in 1996.

A rapid rise in water level remains the primary threat to Piping Plovers at Lake Diefenbaker in many years (e.g. Robinson and Hjertaas 1991, Espie et al. 1994, McAdam 1995, Hjertaas 1996). The impact of rising water level on the overall population will be greatest in years of low winter draw-down of the reservoir, as this results in high plover use in the spring of the resulting wide beaches. Predation and human disturbance also have an impact on losses (e.g. Espie et al. 1992, 1994), although it is comparatively minor. Plovers at Lake Diefenbaker select beaches with the greatest proportion of gravel, and the number of nesting plovers may be limited by the amount of gravel substrate found on beaches (Espie et al. 1996). The lake may be of particular importance to plovers during periods of drought when other basins may have reduced habitat due to drying or low water.

Manitou Lake area

Manitou Lake consistently supports Piping Plovers and was a major nesting area in 1991. However, subsequent surveys show that numbers fluctuate widely, from a low count of 17 birds in 1993 (D. Hjertaas, pers. comm.) to a high of 111 birds in 1991. Counts in other years include 49 birds in 1994 (Weidl 1994), 83 birds in 1995 (D. Duncan), and 63 birds in 1996. Areas of suitable habitat have been identified, and include the north shore, the north shore of the island, and a major portion of the south and southwest shores.

Several lakes west of Manitou lake also provide habitat, most notably Reflex Lake West and Freshwater Lake. The population of Reflex Lake West increased from 17 birds in 1991 to 26 birds in 1996 (the increase on the Saskatchewan portion was from five to seven birds). Freshwater Lake was first surveyed in 1992 when two birds were located (W. Kost, pers. comm.). Subsequent surveys showed increases to 15 birds in 1995 (partial survey; D. Duncan) and 21 birds in 1996 (17 birds on the south basin and four on the north). In recent years the lake has consisted of two basins, with habitat along the west shore where the basins approach each other.

North-central area

Fewer plovers and sites with plovers occurred in the north-central area of the plover's range in 1996 than in 1991. Water levels were considerably higher in 1996, and habitat at many locations was flooded. Only six basins (Buffer, Burke, Middle and Basin lakes, and two unnamed basins) supported a total of 21 plovers in the area northwest from Big Quill and Last Mountain lakes to the South Saskatchewan River. Over the same area in 1991, 14 sites supported 92 plovers.

West area

Small numbers of plovers have been counted at a variety of locations in the western part of the province since 1991, when 14 birds were counted at three sites. In 1996, a total of 18 birds occurred at five locations between the South Saskatchewan River and North Battleford: seven at Seagram Lake West, four at each of Zella and Killsquaw lakes, two at Aroma Lake, and one at an unnamed basin southeast of Landis Lake. Aroma Lake has had 2-5 plovers in every year since 1991, when eight were counted. Although no plovers occurred at Freefight Lake in 1996, 3-6 birds have been counted in three years from 1991 to 1994. At Opuntia Lake, which had no plovers in 1991 or 1996, one pair occurred in 1995, the first record since 1986 when two birds were recorded.

Southwest area

In southwestern Saskatchewan in the vicinity of the Great Sand Hills, plovers occurred at only one location in 1996: four birds at Freefight Lake. In 1991, five birds occurred at Freefight Lake and two at Ingebright Lake. Freefight Lake also had three plovers in 1992 and six in 1994. At Antelope and Bitter lakes, which had no plovers in 1991 or 1996, three pairs (1992; M. Gollop, pers. comm.) and one pair (1993; W.C. Harris, pers. comm.), respectively, occurred in intervening years. An unnamed basin not censused in 1991 or 1996 had three plovers in 1993.

Further south, an unusual record of one plover occurred on a trail near Driscoll Lake, north of the Frenchman River. There are no previous records of plovers in the Cypress Hills and Frenchman River areas (except possibly one 1906 specimen from Maple Creek; Skeel 1990).

Conservation actions

Critical Piping Plover breeding habitat was identified from the results of the 1991 census (Skeel 1991) and transferred to the Saskatchewan Environment and Resource Management Geographic Information System (GIS). Using the same criteria (use by one or more pairs and a reasonable expectation of repeat use) critical habitat was increased to include the results of the 1996 census by adding 14 new basins and extending delineated habitat at four other basins. A total of 84 basins has now been identified as having critical habitat (Skeel et al. 1996). In 1996, an amendment to the Wildlife Habitat Protection Act added approximately 650 ha of shorelines of basins identified in 1991 and since that year to the Wildlife Habitat Lands Disposition and Alteration Regulations that govern protected areas for Piping Plovers and Whooping Cranes *Grus americana*. The vast majority of Piping Plover shoreline habitat is now protected.

In 1991, trampling of beaches by cattle was identified as a major threat to Piping Plover habitat at some nesting locations. A 1992 study of the impact by cattle trampling at 21 basins priorized sites for fencing projects (Harris 1992). Four basins in the Missouri Coteau identified to have high concentrations of Piping Plovers in combination with heavy cattle use were selected by SWCC for fencing projects under the North American Waterfowl Management Plan to keep cattle off beaches. In 1993, a total of 12 km of new fence was constructed and 2.4 km of existing fence was repaired at East Coteau and Channel lakes. East Coteau Lake has been surveyed each year since 1993, and the population has remained stable at the 1991 level of 20-25 birds. In 1994, 9.6 km of new fence was constructed at the southeast corner of Old Wives Lake and Edna Lake. In 1992, Old Wives Lake was found to have severe damage to beaches by cattle; vegetative encroachment when the lake was mostly dry from 1986 to 1992 attracted cattle, which used the beaches for grazing and loafing (Harris 1992).

At Big Quill Lake, SWCC attempted to enhance habitat at areas where the basin had been dry for a number of years. In 1993, two wells were drilled on the east side along the old lake shore. Cattle were fenced out of beaches in the vicinity of the wells, as well as other locations, in conjunction with implementation of a rotational grazing system. A total of 8.8 km of new shoreline fence was constructed in 1993 on the east side, and approximately 9.5 km in 1994 on the east and west sides of the north half. In the spring of 1994 and 1995, water was pumped from the wells onto beaches. In both years pumping water onto beaches did not appear to influence location of nesting plovers or young, or nest or fledging success (Harris 1994, 1995). However, these studies provided valuable information on nest and fledgling success, showing that nest success is usually high, but chick survival is variable and the main cause of variation in productivity at Big Quill Lake.

Lake Diefenbaker, a reservoir managed by Saskatchewan Water Corporation (SWC) primarily for hydro-electric power and irrigation, is recognized as important to Piping Plovers. SERM, SWCC, and the CWS (Environment Canada) are in the process of negotiating an agreement with SWC to look at options for minimizing plover losses due to water level fluctuations. In addition, SWCC has collected additional data on plover productivity at this basin (McAdam 1995; Hjertaas 1996).

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Participants (116 people) in the census were:

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Figure 1. Location of sites censused in Saskatchewan during the 1996 International Piping Plover Census.

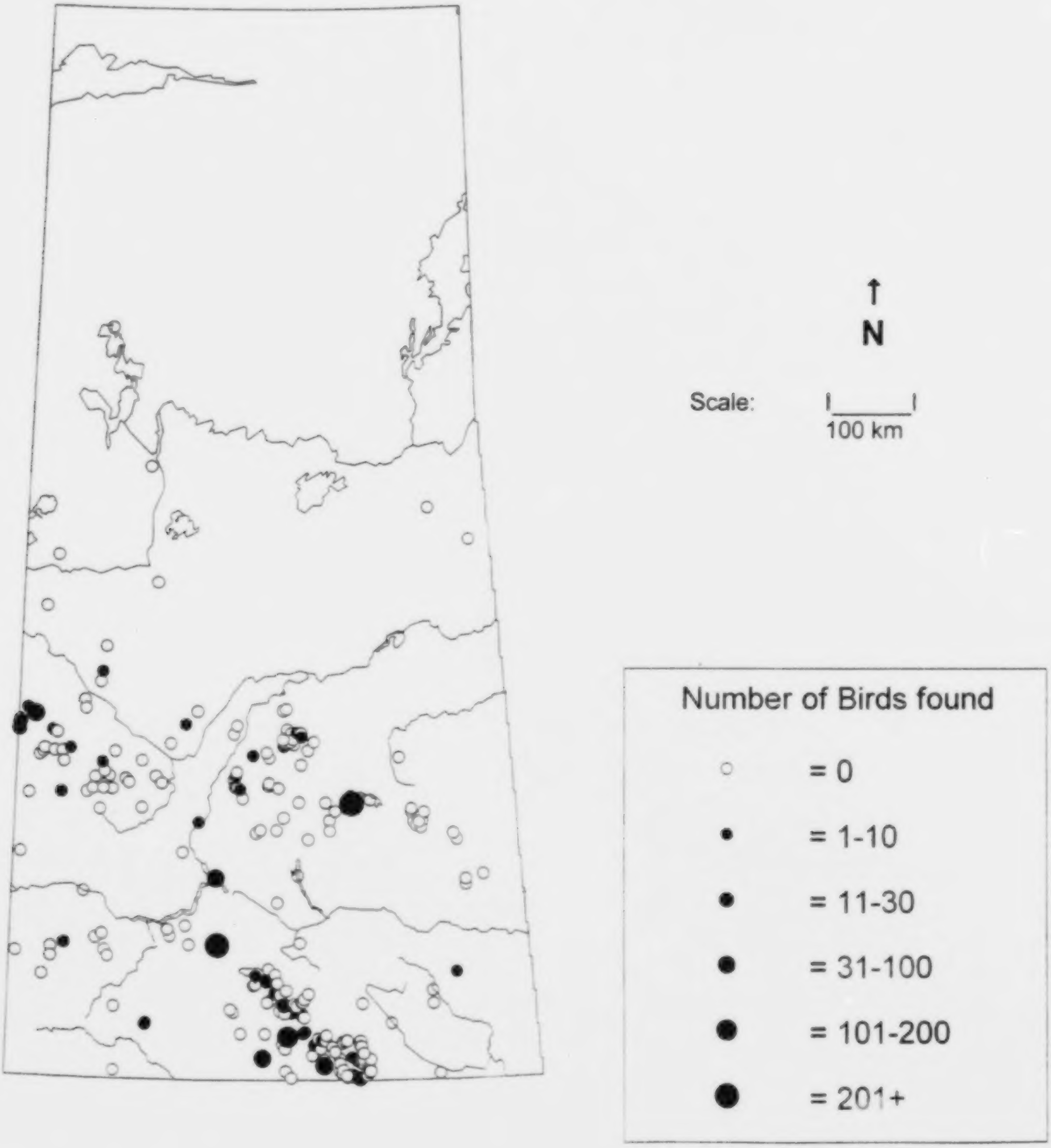
N
Scale:
100 km
Number of Birds found
○ = 0
• = 1-10
● = 11-30
● = 31-100
● = 101-200
● = 201+

Table 1. Locations and numbers of Piping Plovers found in Saskatchewan in 1996.

No.	Date	Map sheet[a]	Site	UTM[b]	Km covered	No. of obs.[c]	No. of adults	No. of pairs	%[d] of habitat	Habitat quality	Water level	Threats to habitat; degree of threat
1	15 June	62L/2	Kipling Marsh	650 530	0.5	1	1	0	50	marginal	low	
2	10 June	72G/12	trail near Driscoll L.[e]	010 956	0.0	1	1	0	NH	unsuitable		
3	3 June	72H/1	Unnamed	414 530	1.0	2	1	0	100	good		cattle; medium
4	7 June	72H/1	East Coteau L.	415 315	9.0	1	24	9	100	good	normal	
5	2 June	72H/1	Little Coteau L.	455 310	1.5	2	2	1	100	marginal		cattle; low
6	13 June	72H/1	Alkali L.	500 280	9.6	1	22	5	100	good	normal	cattle on N; low
7	2 June	72H/1	Unnamed	613 345	1.5	3	1	1	100	good		cattle, trash; med
8	2 June	72H/1	Unnamed	613 353	0.8	1	1	0	100	marginal		cattle; medium
9	5 June	72H/1	Sandoff L.	615 375	8.0	2	28	6	100	good	high	cattle; low
10	15 June	72H/2	Big Muddy L.	090 430	35.0	2	34	14	100	good		cattle; medium
11	1 June	72H/2	unnamed	295 330	2.0	1	5	2	100	marginal		cattle; medium
12	1 June	72H/2	Coteau Pots	300 342	0.5	2	1	0	100	marginal		cattle; high
13	1 June	72H/2	Coteau Pots	300 345	0.5	2	2	1	100	marginal		cattle; high
14	1 June	72H/2	Lonetree L.	355 290	3.0	3	1	0	100	marginal	normal	cattle
15	1 June	72H/4	Grant L.	370 484	3.0	1	1	0	100	marginal		cattle; low
16	1 June	72H/4	North Pond	395 500	1.0	1	1	0	100	marginal		
17	1 June	72H/4	unnamed	400 535	3.0	1	1	0	100	marginal		cattle; low
18	8 June	72H/4,5	Fife L.	370 520	29.0	2	53	13	100	good	normal	reg. park; low
19	2 June	72H/6	unnamed	850 814	1.0	1	2	1	100	good		
20	4 June	72H/6	Coal Mine L.	970 670	8.0	2	10	4	100	good		
21	14 June	72H/6,5	Willow Bunch L.	670 770	113.4	3	124	57	100	good		cattle, ATV; low-med
22	2 June	72H/6,11	Horizon L.	870 825	10.0	1	9	4	100	good		cattle fenced out

Table 1. (continued)

No.	Date	Map sheet[a]	Site	UTM[b]	Km cover -ed	No. of obs.[c]	No. of adults	No. of pairs	%[d] of habitat	Habitat quality	Water level	Threats to habitat; degree of threat
23	3 June	72H/7	Edna L.	060 725	10.0	2	3	0	100	marginal	high	
24	3 June	72H/7	unnamed	304 706	2.5	1	2	0	100	marginal		cattle; low
25	4 June	72H/11	Dryboro L.	640 075	4.0	1	7	4	100	good		
26	4 June	72H/11	unnamed	650 075	0.8	1	1	0	100	marginal		cattle (PFRA[f]); med
27	4 June	72H/11	Burn L.	660 070	9.0	1	17	8	100	good		cattle (PFRA); med
28	4 June	72H/11	unnamed	705 056	3.0	1	11	5	100	good		cattle; low
29	3 June	72H/11	unnamed	714 054	1.5	1	2	1	100	good		
30	3 June	72H/11	unnamed	717 067	1.5	1	2	1	100	marginal		cattle; low
31	4 June	72H/11	Shoe L.	741 095	4.0	1	12	6	100	good		cattle; low
32	4 June	72H/11	unnamed	832 010	1.0	1	2	1	100	marginal		
33	4 June	72H/11	unnamed	840 020	3.5	1	5	2	100	good		
34	4 June	72H/11	unnamed	842 027	3.0	1	5	2	100	good		
35	5 June	72H/11	unnamed	846 992	3.6	1	3	1	96	good		cattle (PFRA); low
36	5 June	72H/11	unnamed	856 984	1.0	1	1	0	100	marginal		cattle (PFRA); low
37	4 June	72H/13	unnamed	540 279	5.0	2	22	8	100	good		
38	5 June	72H/13	unnamed	560 273	3.0	2	4	0	100	good		
39	5 June	72H/13	unnamed	565 273	1.5	2	1	0	100	good		
40	3 June	72H/13	Bliss L.	633 135	10.0	3	18	6	100	good		cattle; low
41	3 June	72H/14	unnamed	842 162	1.5	3	3	1	100	good		
42	8 June	72I/4	Frederick L.	435 425	14.0	2	22	8	100	good	normal	cattle; low
43	7 June	72I/4	unnamed	500 450	3.0	1	5	2	100	good	normal	cattle on N; low
44	6 June	72I/4	unnamed	503 440	3.0	1	4	1	100	good	normal	cattle; low
45	13 June	72I/4,72J/1	Old Wives L.	300 480	115.3	1	8	2	100	marginal	low	
46	5 June	72J/7,1,2,8	Chaplin L.	860 840	62.4	3	205	74	100	good	high	cattle; low
47	6 June	72K/6	Freefight L.	343 845	5.0	1	4	1	100	good		
48	11 June	72N/14	Zella L.	215 590	3.2	1	4	2	100	good	low	cattle; medium

Table 1. (continued)

No.	Date	Map sheet[a]	Site	UTM[b]	Km covered	No. of obs.[c]	No. of adults	No. of pairs	%[d] of habitat	Habitat quality	Water level	Threats to habitat; degree of threat
49	8 June	72O/2,1,72J	Lake Diefenbaker	860 620	256.0	10	75	28	91	good	high	water level; high
50	5 June	72O/10,72O,73B/2	middle South Sask. River	670 270	160.0	3	2	1	100	marginal	normal	water level
51	12 June	72P/16,15,73A/1	Big Quill L.	440 470	122.7	4	435	196	90	good	low	
52	4 June	73A/6,5	unnamed	665 130	1.0	1	2	1	100	good		
53	13 June	73A/11	Basin L.	815 290	26.0	1	3	2	100	marginal		
54	13 June	73A/11	Middle L.	870 235	9.5	1	3	2	100	marginal		
55	11 June	73B/1	Burke L.	105 795	8.0	1	1	0	100	marginal	normal	
56	14 June	73B/1	NW of Blucher	155 642	9.0	1	6	3	100	marginal		
57	3 June	73B/8,73A/5	Buffer L.	310 030	1.5	2	6	2	100	marginal	high	
58	10 June	73B/11,14	Redberry L.	540 400	22.0	2	4	2	100	marginal	high	ATVs on beaches
59	8 June	73C/1	SE of Landis L.	722 817	6.0	1	1	0	99	marginal	normal	
60	6 June	73C/6	Killsquaw Lks	292 100	3.0	1	4	2	100	marginal	low	ATVs; high
61	11 June	73C/7	Aroma L.	670 960	4.5	2	2	1	100	good		
62	6 June	73C/11	Seagram Lks "West"	077 297	10.1	2	7	2	100	good	normal	cattle; low-medium
63	4 June	73C/12	Freshwater L. "South"	690 290	9.4	2	17	8	100	good	low	cattle; low
64	4 June	73C/12	Freshwater L. "North"	692 311	4.8	1	4	2	100	good	low	cattle; medium
65	5 June	73C/12	Reflex Lks "East"	712 371	3.8	3	2	1	100	marginal	low	cattle; medium
66	2 June	73C/12,73D/9	Reflex Lks "West", SK	680 350	3.7	2	7	3	100	good		
67	2 June	73C/13	Wells L.	778 532	0.0	2	1	0	NH	unsuitable	low	cattle; low
68	4 June	73C/13,12	Manitou L.	870 470	77.7	4	63	21	100	good	normal	cattle; low-medium
69	18 June	73F/2	Russell L.	610 000	3.0	2	5	3	100	good	low	
Totals					1258.3	1348	534					

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[a] Missouri Coteau sites are located on map sheets 72H, 72I, and 72J.

[b] UTM = Universal Transverse Mercator.

[c] Number of observers.

[d] Percentage of Piping Plover habitat that was censused. NH indicates no habitat was present.

[e] L. = Lake

[f] PFRA = Prairie Farm Rehabilation Administration.

Table 2. Comparison of 1991 and 1996 population counts of Piping Plovers in Saskatchewan.

No.	Map sheet[a]	UTM[b]	Site	1991 census		1996 census		Percent change	
				No. of adults	No. of pairs	No. of adults	No. of pairs	No. of adults	No. of pairs
1	62E/14	380 160	Rock L.[c]	1	1	0	0		
2	62L/2	650 530	Kipling Marsh	-[d]	-[d]	1	0		
3	72G/12	010 956	Trail near Driscoll L.	-[d]	-[d]	1	0		
4	72H/1	414 530	unnamed	0	0	1	0		
5	72H/1	415 315	East Coteau L.	23	10	24	9	4.3	-10.0
6	72H/1	455 310	Little Coteau L.	0	0	2	1		
7	72H/1	500 280	Alkali L.	0	0	22	5		
8	72H/1	613 345	unnamed	7	3	1	1	-85.7	-66.7
9	72H/1	613 353	unnamed	0	0	1	0		
10	72H/1	615 375	Sandoff L.	25	8	28	6	12.0	-25.0
11	72H/2	090 430	Big Muddy L.	26	8	34	14	30.8	75.0
12	72H/2	295 330	unnamed	0[c]	0[c]	5	2		
13	72H/2	300 342	Coteau Pots	0	0	1	0		
14	72H/2	300 345	Coteau Pots	0	0	2	1		
15	72H/2	355 290	Lonetree L.	2	1	1	0	-50.0	
16	72H/2,1	350 315	West Coteau L.	7	3	0	0		
17	72H/3	636 369	Coronach Reservoir	5	1	0	0		
18	72H/4	370 484	Grant L.	1	0	1	0	0.0	
19	72H/4	395 500	North Pond	0	0	1	0		
20	72H/4	400 535	unnamed	0	0	1	0		
21	72H/4,5	370 520	Fife L.	29	9	53	13	82.8	44.4
22	72H/5	400 800	Montague L.	4	1	0	0		
23	72H/6	850 814	unnamed	0[e]	0[e]	2	1		
24	72H/6	970 670	Coal Mine L.	0	0	10	4		
25	72H/6,5	670 770	Willow Bunch L.	31	16	124	57	300.0	256.3
26	72H/6,11	870 825	Horizon L.	0[e]	0[e]	9	4		
27	72H/7	060 725	Edna L.	7	4	3	0	-57.1	
28	72H/7	185 646	McGrath L.	1	0	0	0		
29	72H/7	215 590	Salt L.	1	0	0	0		
30	72H/7	304 706	unnamed	0[c]	0[c]	2	0		
31	72H/7	310 695	Elsie L.	15	6	0	0		
32	72H/7	335 712	MacDonaugh L.	11	4	0	0		
33	72H/7	360 717	unnamed	1	0	0	0		
34	72H/8	514 656	unnamed	3	0	0	0		
35	72H/8	517 656	Karl L.	2	1	0	0		
36	72H/11	640 075	Dryboro L.	5	3	7	4	40.0	33.3
37	72H/11	650 075	unnamed	2	0	1	0	-50.0	
38	72H/11	660 070	Burn L.	4	2	17	8	325.0	300.0
39	72H/11	705 056	unnamed	15	7	11	5	-26.7	-28.6
40	72H/11	714 054	unnamed	0	0	2	1		
41	72H/11	717 067	unnamed	0	0	2	1		
42	72H/11	741 095	Shoe L.	4	2	12	6	200.0	200.0
43	72H/11	825 855	Channel L.	19	5	0	0		
44	72H/11	832 010	unnamed	0	0	2	1		
45	72H/11	840 020	unnamed	8	3	5	2	-37.5	-33.3
46	72H/11	842 003	unnamed	2	0	0	0		
47	72H/11	842 027	unnamed	0	0	5	2		
48	72H/11	846 992	unnamed	4	2	3	1	-25.0	-50.0
49	72H/11	856 984	unnamed	0[e]	0[e]	1	0		
50	72H/12,13	475 190	Lake of the Rivers	6	2	0	0		

Table 2. (continued)

No.	Map sheet[a]	UTM[b]	Site	1991 census		1996 census		Percent change	
				No. of adults	No. of pairs	No. of adults	No. of pairs	No. of adults	No. of pairs
51	72H/13	540 279	unnamed	11	5	22	8	100.0	60.0
52	72H/13	560 273	unnamed	0	0	4	0		
53	72H/13	565 273	unnamed	0	0	1	0		
54	72H/13	633 135	Bliss L.	3	1	18	6	500.0	500.0
55	72H/14	735 197	Skyeta L.	2	1	-[d]	-[d]		
56	72H/14	750 145	Oro L.	1	0	0	0		
57	72H/14	842 162	unnamed	2	1	3	1	50.0	0.0
58	72I/4	435 425	Frederick L.	12	5	22	8	83.3	60.0
59	72I/4	500 450	unnamed	0	0	5	2		
60	72I/4	503 440	unnamed	0	0	4	1		
61	72I/4,72J/1	300 480	Old Wives L.	42	17	8	2	-81.0	-88.2
62	72J/1	170 394	unnamed	1	0	0[e]	0[e]		
63	72J/6	310 956	Handsome L.	1	0	0	0		
64	72J/6,7	530 850	Reed L.	1	0	0	0		
65	72J/7,1,2,8	860 840	Chaplin L.	113	51	205	74	81.4	45.1
66	72K/6	195 795	Ingebright L.	2	1	0	0		
67	72K/6	343 845	Freefight L.	5	2	4	1	-20.0	-50.0
68	72N/14	215 590	Zella L.	0	0	4	2		
69	72N/15	510 610	Tramping L., South end	2	1	0	0		
70	72O/2,1 72J	860 620	Lake Diefenbaker	276	122	75	28	-72.8	-77.1
71	72O/10, 72O, 73B/2	670 270	"middle" South Sask. River	1	0	2	1	100.0	
72	72P/3,6,72I	810 640	Last Mountain L.	9	3	0	0		
73	72P/10	182 272	Lac du Chemin	5	2	0	0		
74	72P/10	185 155	Kutawagan L. complex	8	3	0	0		
75	72P/11,12, 13	660 307	Little Manitou L.	28	12	0	0		
76	72P/11,6	935 055	Colt L.	4	2	0	0		
77	72P/15	247 380	borrow pit	1	0	0	0		
78	72P/16,15, 73A/1	440 470	Big Quill L.	151	54	435	196	188.1	263.0
79	72P/16, 72M/13	650 510	Little Quill L.	13	5	0	0		
80	73A/5	500 000	Muskiki L.	11	5	0	0		
81	73A/5,6	665 130	unnamed	0	0	2	1		
82	73A/6	940 080	Houghton L.	7	3	0	0		
83	73A/10,6,7, 11	010 180	Lenore L.	9	4	0	0		
84	73A/11	815 290	Basin L.	4	1	3	2	-25.0	100.0
85	73A/11	865 282	Elkona L.	5	3	0	0		
86	73A/11	870 235	Middle L.	4	1	3	2	-25.0	100.0
87	73B/1	103 667	NW of Blucher	2	1	0	0		
88	73B/1	105 795	Burke L.	0	0	1	0		
89	73B/1	155 642	NW of Blucher	1	1	6	3	500.0	200.0
90	73B/6	365 180	Radisson L.	5	0	0	0		

Table 2. (continued)

No.	Map sheet[a]	UTM[b]	Site	1991 census		1996 census		Percent change	
				No. of adults	No. of pairs	No. of adults	No. of pairs	No. of adults	No. of pairs
91	73B/8,73A/5	310 030	Buffer L.	3	1	6	2	100.0	0.0
92	73B/11,14	540 400	Redberry L.	21	11	4	2	-82.0	-81.8
93	73C/1	722 817	SE of Landis L.	0	0	1	0		
94	73C/6	292 100	Killsquaw Lks	4	1	4	2	0.0	100.0
95	73C/7	670 960	Aroma L.	8	3	2	1	-75.0	-66.7
96	73C/11	077 297	Seagram Lks “West”	0	0	7	2		
97	73C/12	690 290	Freshwater L. “South”	-[f]	-[f]	17	8		
98	73C/12	692 311	Freshwater L. “North”	-[f]	-[f]	4	2		
99	73C/12	694 390	“Schopfer Slough”	3	1	0	0		
100	73C/12	712 371	Reflex Lks “East”	0	0	2	1		
101	73C/12,73D/9	680 350	Reflex Lks “West”, SK	5	2	7	3	40.0	50.0
102	73C/13	778 532	Wells L.	-[f]	-[f]	1	0		
103	73C/13,12	870 470	Manitou L.	111	51	63	21	-43.2	-58.8
104	73C/15	425 665	Lambert L.	4	2	0	0		
105	73F/2	610 000	Russell L.	0	0	5	3		
Totals				1172	481	1348	534		

[a] Missouri Coteau sites are located on map sheets 72H, 72I, and 72J; also Chaplin Lake.

[b] UTM = Universal Transverse Mercator

[c] L. = Lake

[d] These 2 sites were not censused in 1991, but do not normally support plovers.

[e] Missouri Coteau sites that are assumed to have no plovers because they were not identified as having habitat (6 sites).

[f] Sites not censused (1991: 3 sites; 1996: 1 site). Habitat may have been present.

Table 3. Locations with no Piping Plovers in Saskatchewan in 1996.

No.	Date	Map sheet[a]	Site[b]	UTM[c]	Km covered	No. of obs.[d]	%[e] of habitat	Habitat quality	Water level
1	5 June	62E/3,2	Boundary Dam Res	454 351	0.0	1	NH[e]	unsuitable	high
2	6 June	62E/12	Nickle L.[f]	880 925	3.5	4	90	marginal	high
3	5 June	62E/14	Moose Mountain L.	370 310	0.0	1	NH	unsuitable	high
4	3 June	62E/14	**Rock L.**	**380 160**	0.0	3	NH	unsuitable	normal
5	5 June	62M/1	Crescent L.	765 547	0.0	2	NH	unsuitable	high
6	7 June	62M/1	Leech L.	765 610	0.0	2	NH	unsuitable	high
7	10 June	62M/1	Soda L.	975 670	0.0	2	NH	unsuitable	high
8	10 June	62M/7	Horseshoe L.	663 063	0.0	2	NH	unsuitable	high
9	10 June	62M/10	Good Spirit L.	620 135	0.0	1	NH	unsuitable	high
10	6 June	62M/11	Echo L.	160 270	0.0	2	NH	unsuitable	high
11	3 June	62M/11	Bitter L.	191 224	0.0	2	NH	unsuitable	
12	6 June	62M/11	Dog L.	205 325	0.0	2	NH	unsuitable	high
13	3 June	62M/11	Salt L.	240 232	5.0	2	100	good	high
14	6 June	62M/11	Woody L.	246 200	0.0	2	NH	unsuitable	high
15	6 June	62M/11	Newburn L.	260 280	5.6	1	100	marginal	
16	10 June	62M/14	Usinneskaw L.	128 385	0.0	1	NH	unsuitable	high
17	10 June	62M/14	Margo L.	131 414	0.0	1	NH	unsuitable	high
18	3 June	62M/14	Silver L.	224 264	0.0	2	NH	unsuitable	high
19	10 June	62M/14	Stonewall L.	282 375	0.0	1	NH	unsuitable	high
20	8 June	62D/5	East of Perigord	990 006	0.0	2	NH	unsuitable	
21	8 June	63L/9	*Amisk L., Sandy Beach*	*800 530*	1.0	1	100	marginal	
22	15 June	63L/15	Jan L., main beach	330 890	1.0	1	80	marginal	
23	8 June	72F/1	Lonetree L.	003 399	0.0	1	NH	unsuitable	high
24	7 June	72F/9,16	Notukeu L.	966 140	0.0	1	NH	unsuitable	high
25	11 June	72G/8	Twelve Mile L.	110 805	68.7	1	100	unsuitable	high

Table 3. (continued)

No.	Date	Map sheet[a]	Site[b]	UTM[c]	Km covered	No. of obs.[d]	%[e] of habitat	Habitat quality	Water level
26	3 June	72G/9	unnamed	028 055	0.0	1	NH	unsuitable	
27	3 June	72G/9	unnamed	995 088	2.0	1	100	marginal	
28	10 June	72G/12	Driscol L.	005 940	0.0	1	NH	unsuitable	high
29	3 June	72G/16	unnamed	277 363	0.0	1	NH	unsuitable	
30	3 June	72H/1	unnamed	475 490	3.0	1	100	marginal	
31	3 June	72H/1	unnamed	476 483	0.8	1	100	marginal	
32	3 June	72H/1	unnamed	480 486	0.8	1	100	marginal	
33	3 June	72H/1	unnamed	483 494	0.9	1	100	marginal	
34	3 June	72H/1	unnamed	483 498	0.9	1	100	marginal	
35	4 June	72H/1	unnamed	493 480	0.5	1	100	marginal	high
36	4 June	72H/1	unnamed	495 490	1.0	2	100	marginal	high
37	4 June	72H/1	unnamed	505 486	2.5	2	100	marginal	high
38	4 June	72H/1	unnamed	515 475	4.0	2	100	marginal	high
39	4 June	72H/1	unnamed	533 461	0.0	1	NH	unsuitable	high
40	4 June	72H/1	unnamed	535 455	2.5	2	100	marginal	high
41	4 June	72H/1	unnamed	550 450	1.5	2	100	marginal	high
42	3 June	72H/1	Wellington L.	550 495	0.0	1	NH	unsuitable	high
43	5 June	72H/1	Payn L.	580 333	0.0	2	NH	unsuitable	high
44	5 June	72H/1	Overland L.	590 320	0.0	2	NH	unsuitable	
45	3 June	72H/1	unnamed	591 408	0.0	2	NH	unsuitable	
46	5 June	72H/1	unnamed	628 368	0.0	1	NH	unsuitable	
47	3 June	72H/1	Mather L.	630 504	0.0	1	NH	unsuitable	
48	5 June	72H/2	unnamed	085 495	0.0	2	NH	unsuitable	high
49	5 June	72H/2	Jim Creek L.	267 367	0.0	2	NH	unsuitable	high
50	5 June	72H/2	unnamed	272 510	0.0	2	NH	unsuitable	high
51	4 June	72H/2	unnamed	275 456	0.0	2	NH	unsuitable	high

Table 3. (continued)

No.	Date	Map sheet[a]	Site[b]	UTM[c]	Km covered	No. of obs.[d]	%[e] of habitat	Habitat quality	Water level
52	1 June	72H/2	Coteau Pots	300 350	0.0	1	NH	unsuitable	
53	5 June	72H/2	unnamed	310 378	0.0	2	NH	unsuitable	high
54	15 June	72H/2,1	**West Coteau L.**	**350 315**	12.0	2	100	marginal	
55	1 June	72H/3	**Coronach Reservoir**	**636 369**	0.0	1	NH	unsuitable	high
56	1 June	72H/3	unnamed	702 290	2.0	1	100	marginal	
57	4 June	72H/3	Bulkin L.	948 545	0.0	2	NH	unsuitable	high
58	2 June	72H/5	**Montague L.**	**400 800**	24.3	4	100	marginal	high
59	2 June	72H/5	Bonneau L.	603 680	0.0	3	NH	unsuitable	normal
60	2 June	72H/5,6	Rivard L.	633 625	7.0	1	100	marginal	
61	2 June	72H/6	unnamed	847 800	1.5	1	100	marginal	
62	3 June	72H/7	Ritchie L.	020 739	3.0	1	100	marginal	
63	5 June	72H/7	unnamed	050 625	0.0	2	NH	unsuitable	high
64	3 June	72H/7	Bead L.	108 714	2.0	2	100	marginal	high
65	3 June	72H/7	Green L.	114 781	2.5	2	100	marginal	
66	5 June	72H/7	**McGrath L.**	**185 646**	0.0	2	NH	unsuitable	high
67	5 June	72H/7	**Salt L.**	**215 590**	15.0	2	100	good	high
68	3 June	72H/7	**Elsie L.**	**310 695**	4.0	1	100	marginal	
69	3 June	72H/7	**MacDonaugh L.**	**335 712**	0.0	1	NH	unsuitable	high
70	3 June	72H/7	MacKenzie L.	355 725	0.0	1	NH	unsuitable	
71	3 June	72H/7	**unnamed**	**360 717**	2.0	1	100	marginal	high
72	17 June	72H/8	unnamed	503 713	2.0	1	100	good	
73	17 June	72H/8	unnamed	512 718	3.0	1	100	marginal	
74	18 June	72H/8	**unnamed**	**514 656**	0.0	1	NH	unsuitable	
75	18 June	72H/8	**Karl L.**	**517 656**	2.0	1	100	good	
76	17 June	72H/8	Bowden L.	522 651	1.5	1	100	good	
77	24 June	72H/8	unnamed	543 575	1.5	2	100		
78	24 June	72H/8	unnamed	550 575	2.0	2	100		
79	4 June	72H/11	unnamed	646 076	0.3	1	100	marginal	

Table 3. (continued)

No.	Date	Map sheet[a]	Site[b]	UTM[c]	Km covered	No. of obs. [d]	%[e] of habitat	Habitat quality	Water level
80	4 June	72H/11	unnamed	662 075	0.0	1	NH	unsuitable	
81	4 June	72H/11	unnamed	691 060	1.0	1	100	marginal	
82	3 June	72H/11	unnamed	698 105	2.5	1	100	good	
83	4 June	72H/11	unnamed	700 080	1.0	1	100	marginal	
84	3 June	72H/11	unnamed	725 075	2.0	1	100	marginal	
85	4 June	72H/11	unnamed	738 085	1.0	1	100	marginal	
86	4 June	72H/11	unnamed	739 075	0.3	1	100	marginal	
87	5 June	72H/11	**Channel L.**	**825 855**	0.0	2	NH	unsuitable	high
88	5 June	72H/11	unnamed	841 995	24.0	1	100	marginal	
89	4 June	72H/11	**unnamed**	**842 003**	1.0	1	100	marginal	
90	5 June	72H/11	unnamed	851 988	0.4	1	100	unsuitable	
91	5 June	72H/11	unnamed	860 985	0.8	1	100	marginal	
92	3 June	72H/12	unnamed	578 063	3.0	1	100	marginal	
93	3 June	72H/12	unnamed	632 035	0.0	1	NH	unsuitable	
94	16 June	72H/12,13	**Lake of the Rivers**	**475 190**	24.0	1	100	unsuitable	normal
95	4 June	72H/13	unnamed	295 375	0.0	3	NH	unsuitable	high
96	3 June	72H/13	unnamed	430 164	0.0	1	NH	unsuitable	high
97	4 June	72H/13	unnamed	590 248	0.0	2	NH	unsuitable	
98	5 June	72H/14	unnamed	650 295	0.0	1	NH	unsuitable	high
99	5 June	72H/14	Agnellice L.	660 300	0.0	2	NH	unsuitable	high
100	5 June	72H/14	**Oro L.**	**750 145**	3.0	2	100	marginal	high
101	5 June	72H/14	unnamed	775 125	0.0	2	NH	unsuitable	
102	5 June	72H/14	unnamed	776 116	1.0	2	100	marginal	
103	3 June	72H/14	unnamed	831 160	0.0	3	NH	unsuitable	
104	3 June	72H/14	unnamed	845 167	0.6	2	100	good	
105	3 June	72H/14	unnamed	848 171	1.0	3	100	good	

Table 3. (continued)

No.	Date	Map sheet[a]	Site[b]	UTM[c]	Km covered	No. of obs.[d]	%[e] of habitat	Habitat quality	Water level
106	3 June	72H/14	unnamed	849 167	1.0	1	100	marginal	
107	3 June	72H/14	unnamed	857 197	0.0	3	NH	unsuitable	
108	3 June	72H/14	unnamed	863 200	0.0	3	NH	unsuitable	
109	3 June	72H/14	unnamed	915 261	1.0	3	100	marginal	
110	6 June	72H/16	*Ibsen L.*	*540 150*	0.0	3	NH	unsuitable	high
111	6 June	72I/4	*unnamed*	*455 552*	0.0	1	NH	unsuitable	normal
112	7 June	72I/4	unnamed	534 490	2.0	1	100	marginal	normal
113	7 June	72I/4	Howe Pond	556 388	0.5	1	100	good	normal
114	9 June	72I/13	Lovering L. "east"	572 326	0.0	4	NH	unsuitable	high
115	13 June	72J/6	**Handsome L.**	**310 956**	0.0	5	NH	unsuitable	high
116	7 June	72J/6, 7	**Reed L**	**530 850**	0.0	1	NH	unsuitable	high
117	13 June	72J/11	Salt L.	288 035	0.0	5	NH	unsuitable	high
118	13 June	72J/11	unnamed	493 073	0.0	5	NH	unsuitable	high
119	11 June	72K/3	south of Tenaille L.	110 467	2.0	1	75	marginal	high
120	1 June	72K/5	MacLaren L.	790 720	0.0	2	NH	marginal	high
121	23 June	72K/6	**Ingebright L.**	**195 795**	1.0	1	60	good	
122	10 June	72K/6,3	Bigstick L., "north and west sides"	200 685	0.0	2	NH	unsuitable	high
123	9 June	72K/8	Success L.	705 925	0.0	2	NH	unsuitable	high
124	3 June	72K/8	*north of Antelope L.*	*818 790*	0.0	1	NH	unsuitable	high
125	3 June	72K/8,1	Antelope L.	860 720	0.0	1	NH	unsuitable	high
126	2 June	72K/9,8, 7	Snakehole L.	783 975	0.0	2	NH	marginal	
127	6 June	72K/15, 72K,72N	upstream South Sask. River	540 460	168.0	2	80	marginal	high
128	13 June	72N/5	Alsask L.	783 877	2.0	1	50	marginal	
129	14 June	72N/13	Plover L.	845 558	3.0	1	100	marginal	low
130	10 June	72N/15	**Tramping L. "south end"**	**510 610**	12.0	1	100	marginal	normal
131	11 June	72N/15	Opuntia L.	675 420	16.0	1	100	marginal	normal
132	2 June	72O/6	Stockwell L.	480 925	0.0	2	NH	marginal	high
133	4 June	72O/13	north of Valley Center	025 454	3.0	1	100	good	

Table 3. (continued)

No.	Date	Map sheet[a]	Site[b]	UTM[c]	Km covered	No. of obs.[d]	%[e] of habitat	Habitat quality	Water level
134	9 June	72O/16	Bradwell Resevoir	182 535	0.0	2	NH	unsuitable	
135	6 June	72P/3,6,7 2l	**Last Mountain L.**	**810 640**	280.0	2	100	unsuitable	high
136	5 June	72P/10	**Lac du Chemin**	**182 272**	3.0	2	100	marginal	high
137	8 June	72P/10	**Kutawagan L. complex**	**185 155**	0.0	1	NH	unsuitable	high
138	4 June	72P/11, 12, 13	**Little Manitou L.**	**660 307**	16.0	2	100	marginal	high
139	4 June	72P/11, 6	**Colt L.**	**935 055**	4.0	2	100	marginal	high
140	16 June	72P/12	Horseshoe L.	335 133	0.0	2	NH	unsuitable	high
141	16 June	72P/12	Bultel L.	385 166	0.2	2	100	marginal	high
142	16 June	72P/12	Devil's L.	575 165	0.8	2	100	marginal	high
143	3 June	72P/14	unnamed	832 482	0.0	1	NH	unsuitable	high
144	6 June	72P/15	Jansen L.	140 480	0.0	2	NH	unsuitable	
145	5 June	72P/16	**borrow pit**	**247 380**	0.0	2	NH	unsuitable	high
146	8 June	72P/16	Mud L. ("Middle Quill L.")	540 530	0.0	1	NH	unsuitable	high
147	8 June	72P/16 72M/13	**Little Quill L.**	**650 510**	0.0	1	NH	unsuitable	high
148	9 June	73A/4	Meacham "South"	485 681	0.0	1	NH	unsuitable	normal
149	9 June	73A/4	Meacham "East"	492 704	0.0	1	NH	unsuitable	normal
150	9 June	73A/4	SE of Meacham	603 647	9.0	1	100	marginal	normal
151	4 June	73A/5	**Muskiki L.**	**500 000**	0.0	2	NH	unsuitable	high
152	8 June	73A/6	Waldsea L.	862 915	0.0	1	NH	unsuitable	high
153	7 June	73A/6	**Houghton L.**	**940 080**	0.0	1	NH	unsuitable	high
154	4 June	73A/6,11	*unnamed*	*670 165*	0.0	1	NH	unsuitable	high
155	4 June	73A/6,11	*unnamed*	*710 160*	0.0	1	NH	unsuitable	high
156	3 June	73A/6,11	*Lucien L.*	*783 150*	0.0	1	NH	unsuitable	
157	6 June	73A/8	Charron L.	470 060	4.5	2	100	unsuitable	
158	7 June	73A/10,6, 7,11	**Lenore L.**	**010 180**	0.0	2	NH	unsuitable	high
159	4 June	73A/11	Marie L.	670 180	0.0	1	NH	unsuitable	high
160	4 June	73A/11	*Arthur L.*	*700 240*	0.0	1	NH	unsuitable	high
161	9 June	73A/11	*Shannon L.*	*707 325*	9.6	2	100	marginal	high

Table 3. (continued)

No.	Date	Map sheet[a]	Site[b]	UTM[c]	Km covered	No. of obs.[d]	%[e] of habitat	Habitat quality	Water level
162	9 June	73A/11	*Sayer L.*	*735 225*	0.0	2	NH	unsuitable	high
163	8 June	73A/11	*Louis L.*	*745 180*	0.0	2	NH	unsuitable	high
164	7 June	73A/11	*Bruno L.*	*755 280*	0.0	2	NH	unsuitable	high
165	8 June	73A/11	*McIntyre L.*	*770 210*	0.0	2	NH	unsuitable	high
166	7 June	73A/11	**Elkona L.**	**865 282**	0.0	1	NH	unsuitable	high
167	4 June	73A/12,11	Olivier L.	660 207	0.0	1	NH	unsuitable	High
168	7 June	73A/14	Jumping L. (Small)	665 540	0.0	1	NH	unsuitable	high
169	7 June	73A/14	Jumping L. (Big)	700 560	6.0	1	100	marginal	high
170	11 June	73B/1	Patience L.	085 750	12.8	2	100	good	normal
171	14 June	73B/1	**NW of Blucher**	**097 670**	0.0	1	NH	unsuitable	high
172	14 June	73B/1	NW of Blucher	103 667	1.0	1	100	good	
173	11 June	73B/1	Porter L.	120 840	0.0	1	NH	unsuitable	normal
174	14 June	73B/1	Esker Slough	124 657	2.0	1	100	marginal	
175	31 May	73B/4	NW of Van Scoy	190 810	4.5	2	100	good	low
176	31 May	73B/4	Van Scoy L.	255 730	0.0	2	NH	unsuitable	
177	3 June	73B/5	Lizard L.	037 997	3.5	1	100	marginal	high
178	10 June	73B/6	**Radisson L.**	**365 180**	0.0	1	NH	unsuitable	high
179	4 June	73B/9	Marion L.	092 277	3.2	1	100	unsuitable	high
180	4 June	73B/9	Rempel L.	130 375	1.6	1	100	unsuitable	high
181	2 June	73B/15	Blaine L. "North"	680 545	0.0	1	NH	unsuitable	high
182	8 June	73C/1	west of Whiteshore L.	764 805	4.8	1	100	marginal	normal
183	7 June	73C/1	Lydden L.	806 662	0.0	1	NH	unsuitable	normal
184	9 June	73C/1	Oban L.	951 783	5.2	1	100	good	normal
185	9 June	73C/1	Castlewood L.	995 745	11.9	1	99	good	low
186	7 June	73C/2	*Little Tramping L.*	*576 654*	0.0	1	NH	unsuitable	
187	7 June	73C/2	N of Handel	600 784	7.5	1	100	marginal	normal
188	15 June	73C/2	Sunny L.	700 662	0.0	2	NH	unsuitable	
189	7 June	73C/2,1	Landis L.	701 853	10.5	1	100	good	normal

Table 3. (continued)

No.	Date	Map sheet[a]	Site[b]	UTM[c]	Km covered	No. of obs.[d]	%[e] of habitat	Habitat quality	Water level
190	16 June	73C/5	Zoller L.	944 004	0.0	2	NH	unsuitable	
191	16 June	73C/5	Winterhaldt L.	980 044	0.0	2	NH	unsuitable	
192	16 June	73C/5	Chisholm L.	993 080	4.0	2	100	marginal	
193	15 June	73C/6	Reed L. "northwest"	110 061	0.0	2	NH	unsuitable	
194	15 June	73C/6	Jay L.	200 060	3.0	2	100	marginal	
195	15 June	73C/6	Ear L.	222 945	0.0	2	NH	unsuitable	
196	4 June	73C/8	Keppel L.	812 090	1.5	1	100	marginal	
197	6 June	73C/11	Seagram Lks "East"	128 272	14.6	2	100	unsuitable	normal
198	5 June	73C/12	**"Schopfer Slough"**	**694 390**	5.3	3	100	good	
199	6 June	73C/15	**Lambert L.**	**425 665**	0.0	1	NH	unsuitable	normal
200	9 June	73C/15	*Atton L.*	*442 568*	0.0	1	NH	unsuitable	low
201	19 June	73F/2	*Blackfoot L.*	*595 880*	3.0	2	85	marginal	low
202	29 June	73F/7	Stony L.	635 295	6.0	1	50	marginal	
203	9 June	73F/13	Peck L.	925 725	0.9	1	100	marginal	
204	8 June	73J/4	Green L.	255 050	0.4	1	100	marginal	
205	10 June	73K/5,6	Lac des Isles	020 320	8.5	2	80	good	normal
206	7 June	73N/15	Peter Pond L., Sandy Pt.	460 950	6.5	1	100	marginal	high
207	7 June	73O/5	Lac Ile-a-la Crosse	200 385	0.8	1	100	marginal	

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[a] Missouri Coteau sites are located on map sheets 72H (excluding 72H16) and 72I. Sites north of the Piping Plover's usual range are located on map sheets 63L and 73F, J, K, N, and O.

[b] Bold type denotes sites with one or more plovers in 1991 (34 sites); italics denotes sites not censused in 1991 (16 sites).

[c] UTM = include what nos. mean.

[d] No. of observers.

[e] Percentage of Piping Plover habitat that was censused. NH indicates no habitat was present.

[f] L. = Lake.

2.9 The 1996 Piping Plover census in Alberta

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Abstract

The Alberta portion of the 1996 International Piping Plover Breeding Census was conducted during 31 May -5 July, with the majority of work being accomplished during 1-10 June. This census targeted: 1) all lakes included in the 1991 breeding census in Alberta except Neutral Hills C2 2) other lakes where Piping Plover *Charadrius melodus* had been documented and, 3) additional lakes with potential Piping Plover habitat. Census methods followed the guidelines of the 1996 International Piping Plover Breeding Census. The provincial census was co-ordinated by Alberta Environmental Protection. Fifty-nine individuals from a variety of agencies participated in the census.

A total of 103 lakes were censused in 1996. Piping Plovers were located at 31 of these lakes. In total, 276 adults (109 pairs and 58 unpaired adults) were observed. Two lakes (Dowling Lake and Handhills Lake) supported 39.1% of the provincial population. Forty-six lakes were censused in both 1991 and 1996. Twenty-eight (15.6%) more adult Piping Plovers were observed on these lakes in 1996 than in 1991. Of the 46 lakes inventoried in both 1991 and 1996, 16 supported Piping Plover during both censuses, 10 had Piping Plover in 1991 but not 1996, 4 had Piping Plover in 1996 but not 1991, and 16 had no Piping Plover in either year. Of 41 lakes inventoried in both 1986 and 1996, there were 24% fewer plovers observed in 1996 however the total decrease was 4.2% (288 in 1986 vs. 276 in 1996).

Water levels were generally higher in 1996 than in 1991. Participants in the 1996 census rated 32.7% of lakes as "low". In 1991, 55.3% of lakes received this rating. Vegetation encroachment on Piping Plover habitat was noted at 74.1% of the lakes that supported Piping Plovers in 1996. Human-related disturbances and the proportions of plover-occupied lakes affected were as follows: livestock (cattle) 82.6%, human foot traffic 13%,

motorized vehicles 17.4%, industrial 4.3%. No disturbance was observed at 13% of lakes that supported Piping Plovers. Between 1991 and 1996, management activities designed to protect/enhance habitat were undertaken at Little Fish Lake, Killarney Lake, "Rider Lake", and Rockeling Bay. In addition, two types of predator exclosures have been evaluated, and a wide range of educational materials have been distributed to cottage owners, landowners adjacent to Piping Plover lakes and the general public.

Résumé

La portion albertaine du recensement international des pluviers de 1996 a été effectuée du 31 mai au 5 juillet, la majorité du travail ayant été accompli entre le 1^er^ et le 10 juin. Ce recensement visait : 1) tous les lacs inclus dans le recensement de 1991 en Alberta à l'exception de Neutral Hills C2, 2) d'autres lacs où le Pluvier siffleur (*Charadrius melodus*) a été observé et 3) d'autres lacs possédant un habitat approprié pour cet oiseau. Les méthodes utilisées pour le recensement étaient conformes aux directives mises en œuvre lors du recensement international des pluviers siffleurs de 1996. Le recensement provincial a été coordonné par le ministère de la Protection de l'environnement de l'Alberta. Cinquante-neuf personnes provenant de diverses agences ont participé au recensement.

Au total, 103 lacs ont été explorés en 1996 et des pluviers siffleurs ont été repérés sur 31 d'entre eux. Au total, 276 adultes (109 couples et 58 solitaires) ont été observés. Deux lacs, le lac Dowling et le lac Handhills, accueillent 39,1 % de la population provinciale. Quarante-six lacs ont été explorés en 1991 et en 1996. On a observé une augmentation de 15,6 % des effectifs des pluviers siffleurs sur ces lacs pendant cet intervalle. Des 46 lacs répertoriés en 1991 et en 1996, 16 abritaient des pluviers siffleurs lors des deux recensements, 10 n'en abritaient que lors du recensement de 1991, 4 n'en abritaient que lors du recensement de 1996 et 16 n'abritaient aucun pluvier lors des deux recensements. Sur les 41 lacs explorés en 1986 et en 1996, on a observé une diminution de 24 % du nombre de pluviers observés mais la diminution globale des effectifs n'était que de 4,2 % (288 en 1986 contre 276 en 1996).

L'eau était généralement plus haute en 1996 qu'en 1991. Les participants au recensement de 1996 ont coté 32,7 % des lacs dans la catégorie « faible ». En 1991, 55,3 % des lacs étaient dans cette catégorie. L'envahissement par les plantes des habitats du Pluvier siffleur a été constaté sur 74,1 % des lacs qui abritaient ces oiseaux en 1996. Pour chaque perturbation humaine, le pourcentage des lacs affectés est comme suit : 82,6 % par le bétail, 13 % par les sentiers et les routes piétonnes, 17,4 % par les véhicules motorisés, 4,3 % par l'industrie. Parmi les lacs qui abritaient des pluviers siffleurs, seulement 13 % n'étaient affectés par aucune perturbation. Entre 1991 et 1996, des activités de gestion visant à protéger et à mettre en valeur les habitats ont été entreprises au lac Little Fish, au lac Killarney, au lac Rider et sur la baie Rockeling. De plus, deux types d'exclusion des prédateurs ont été évalués et une vaste gamme de documents éducatifs ont été distribués aux propriétaires de chalets et/ou de terres adjacentes aux lacs abritant les pluviers siffleurs et aux grand public.

Introduction

The Piping Plover is a species of concern throughout its range, being classified as endangered in Canada (Haig 1985) and threatened in most of the United States except the Great Lakes population in the U.S. which is classified as endangered. In Alberta, the Piping Plover is classified as "endangered" and is included on the Alberta "Red List" as a species in danger of declining to non-viable population levels (Alberta Environmental Protection 1996). In response to relatively low populations and uncertainty about population size, the Piping Plover recovery teams in Canada and the United States planned a series of international censuses to be conducted once every five years beginning in 1991 (Flemming 1994). The major objective of the census effort was to gather population data from both breeding and wintering habitats to assess success of recovery efforts (see Guidelines For The 1996 International Piping Plover Breeding Census –Plissner and Haig 1997).

In Alberta, Piping Plovers breed on unvegetated gravel beaches of lakes in the aspen parkland, northern fescue grasslands and mixed grass natural areas (Prescott 1997). The first relatively intensive inventories of Piping Plovers in Alberta were conducted by Wershler and Wallis (1987) and Wershler (1989). The number of adult Piping Plovers counted in the Alberta portion of the 1991 international census was 180 at 26 of the 47 sites inventoried

(Hofman 1994). This number was down from 288 adults documented in 1986 (Wershler and Wallis 1987). In this paper, we report the results of the Alberta portion of the 1996 international census. We also report results of habitat assessments from each lake and summarizes conservation and management activities conducted between 1991 and 1996. Potential census sites were priorized as follows: 1) all lakes included in the 1991 census, 2) other lakes where Piping Plover had been documented (either before or after the 1991 census), and 3) additional lakes with potential Piping Plover habitat.

Methods

The 1996 International Piping Plover Census in Alberta was co-ordinated by Alberta Environmental Protection - Wildlife Management Section, Parkland Region. Censusers were recruited from appropriate staff of Alberta Environmental Protection (AEP), Canadian Wildlife Service (CWS), Ducks Unlimited Canada, North American Waterfowl Management Plan (NAWMP), and other sources (including local naturalist clubs, University of Alberta and the Royal Tyrrell Museum). Primary censusers had previous experience with Piping Plovers or other shorebirds. Less experienced individuals assisted primary censusers. In all, 59 individuals participated.

All but one of the 47 lakes covered by the 1991 census were included in the 1996 census. The one remaining lake (Neutral Hills "C2") could not be included because censusers were denied access. All lakes where Piping Plover were observed subsequent to the 1991 census were also included. A comprehensive review of Piping Plover sightings made prior to the 1991 census and a series of meetings and discussions with wildlife professionals and naturalists were used to identify additional lakes with the potential to support Piping Plover in 1996. A fixed-wing aircraft (Cessna 172) was used to confirm the presence or absence of unvegetated and/or sparsely vegetated beaches on remote lakes that census participants were not familiar with. Lakes that were inspected from the air but excluded from ground searches are not included in the list of lakes inventoried in the 1996 census.

Upon finalizing the list of lakes to be censused and the personnel involved, specific assignments were made. Generally, personnel were assigned to lakes they were familiar with. The survey co-ordinator prepared a package for each lake which included survey protocol and guidelines, individual census report forms, the 1996 Alberta Piping Plover census habitat evaluation form, 1:50,000 National Topographic System maps, air photos (if available), and previous census results (if available).

During May 1996, J. P. Goossen (CWS) led two field-training sessions to familiarize censusers with field procedures. Lake-specific inventory packages were distributed at these training sessions, and all aspects of census protocol were discussed.

Field procedures followed "Guidelines for the 1996 International Piping Plover Breeding Census" (Plissner 1995). All but 7 of the 103 lakes were censused completely between 1 June and 11 June. Six of seven remaining lakes were censused prior to June 15 (Table 1). Pair and adult numbers for Chain Lakes "#4" were derived from a 3 June census and a subsequent 5 July census. Only adult birds were included.

Censusers were encouraged to travel near (within one-third of the beach width) the waters edge. Locating nests was discouraged in order to minimize searching time (generally less than five minutes/territory). Travel was normally by foot, but all-terrain vehicles (ATVs), boats and canoes were used on some large lakes. Data were recorded on the standard data forms provided by the Great Lakes/Northern Great Plains Recovery Team. Information on conservation and management activities were summarized following discussions with personnel from the various agencies conducting this work in Alberta.

Results

Populations

The 1996 breeding Piping Plover census recorded 276 adults (109 pairs and 58 unpaired adults), at 31 of 103 censused waterbodies (Table 1, Fig. 1). Three lakes (Handhills, Dowling and Killarney) supported 47.5% of the adults recorded in this census. Nine other lakes ("Reflex West", Beaverhill, Birch, Chain Lakes "#4", Akasu, "Piper", Horseshoe, Muriel and Sunken) supported an additional 38% of the population. Together, these 12 lakes supported 85.5% of the provincial population during the 1996 census.

Forty-six of 47 ("North Handhills" and "South Handhills" in the 1991 census are the same lake) waterbodies censused in 1991 were also censused in 1996 (Table 2). A total of 208 adults were counted at 20 sites in 1996. This is an increase of 15.6% over the 180 adults counted at 26 sites in 1991. The single waterbody ("Neutral Hills C2") that was not inventoried in 1996 did not support any plovers in 1991. The overall increase between 1991 and 1996 was 96 adult Piping Plover (53.3%).

Of the 46 sites inventoried during 1991 and 1996, 16 sites had Piping Plovers present in both years, 10 had Piping Plovers in 1991 but not 1996, four lakes had Piping Plovers in 1996 but not 1991, and 16 lakes had no Piping Plovers in either year. The most dramatic decreases were at Little Fish Lake, Gooseberry Lake, "Rider Lake", and Rockeling Bay, which decreased from 19, 9, 7 and 6 Piping Plovers respectively to 0 in each case. Dramatic increases occurred at Dowling Lake and Handhills Lake. Counts increased from 21 and 20, respectively, to 54 birds each. While plover numbers increased overall, they decreased at nearly twice as many lakes as they increased at (17 decreases vs. 9 increases - Table 2).

Of the 57 waterbodies inventoried in 1996 but not 1991, only 11 supported plovers. Four of these (Akasu - 10 birds, Beaverhill - 13 birds, Birch - 14 birds, and Muriel - 17 birds) accounted for over 79.4% (54 of 68) of all the plover found at lakes that were not inventoried in 1991. While the 1996 census recorded more birds than the 1991 census, it recorded fewer birds than a 1986 inventory (Wershler and Wallis 1987). Wershler and Wallis (1987) recorded a total of 288 adult Piping Plovers occupying 28 of the 100+ (includes Killarney Lake which was visited but not censused) lakes they investigated during 17 May – 14 June 1986. The total count obtained in 1996 (276 adults) represents a 4.2% decrease from 1986. A comparison of 41 lakes inventoried during both 1986 and 1996 (Table 3) indicates a 24% decrease over this period. Plover numbers decreased at 22 lakes and increased at nine of the lakes that were censused in both 1986 and 1996.

Habitat Assessment

Habitat characteristics explain much of the variation in plover numbers among different lakes in 1996 (Table 4). Censusers rated habitat suitability as either "good", "marginal" or "unsuitable". Twelve of 13 lakes that supported five or more plovers (principal lakes) and were rated by censusers received the "good" rating. Gravel was present on the shores of 25 of 26 lakes that supported plovers where presence or absence of gravel was noted by censusers. It was absent from nearly half of the lakes where plovers were not found (Table 4). Wide beaches, firm (as opposed to soft) substrates and the presence of salt deposits were also associated with higher plover numbers (Table 4).

Threats

Censusers noted vegetation encroachment around 11 of the 12 principal lakes and at nine of 15 secondary lakes where vegetation information was provided (Table 5). New habitat was being exposed at six of 13 principal lakes and six of 16 secondary lakes. Livestock grazing was the predominate disturbance noted on Piping Plover lakes (Table 5). Vehicles (including ATVs), human "foot traffic", and industrial (oil and/or gas) activity were also noted (Table 5), but only eight instances of these kinds of other disturbances were noted at lakes that supported plovers in 1996 (Table 5). The most serious disturbances noted were: potential stabilization of "Rider Lake" and Rockeling Bay, cattle and human activity at "Reflex Lake", and cattle activity at Gooseberry and Handhills lakes. Disturbances will be investigated further and mitigation priorities will be established.

Management Activities

J. P. Goossen began monitoring Piping Plover populations and production at seven Alberta lakes (Chain Lakes "#4", Chappice Lake, Dowling Lake, Handhills Lake, "Reflex Lake", "Rider Lake" and Rockeling Bay) in 1989 and has continued this work at most of these lakes through 1996. Goossen also revised CWS's Piping Plover brochure in the "Hinterland Who's Who" series. The revised version was released in 1995 and distributed by a number of wildlife agencies. AEP also released and distributed a revised version of its Piping Plover brochure (in the Alberta's Threatened Wildlife series).

With the exception of the activities noted above (and the organization of the 1996 census) most other management activities conducted in Alberta between 1991 and 1996 were associated with the "Alberta ad hoc Committee on Piping Plover Management". This committee was established by the Alberta NAWMP Centre in 1991 to facilitate jointly funded projects. One of the first initiatives of the committee was a report on habitat issues (Wershler 1992) that was funded jointly by the Alberta NAWMP Centre and AEP (Fish and Wildlife Management). The ad hoc Committee also facilitated several evaluations of productivity and predator exclosures (J. P. Goossen unpubl. data, Heckbert 1994, Heckbert and Cantelon 1996, and Richardson 1996) and dealt with a wide range of habitat management initiatives. At Killarney Lake, Alberta Prairie Care staff constructed fences and alternative watering sites to keep cattle off nesting beaches. A similar fencing project has been developed for Handhills Lake by AEP, and one is being considered for "Reflex Lake" by Alberta Prairie Care and Partners.

At Rockeling Bay and "Rider Lake" land has been purchased through NAWMP - Alberta Prairie Care. In addition, a variety of management techniques (burning, snow compaction and temporary fencing) have been employed to slow the rate of habitat degradation, and a water management plan has been developed to mitigate the impact of the Buffalo Lake Stabilization Project. The latter plan calls for occasional filling of Rockeling Bay and "Rider Lake" to maintain unvegetated shoreline. In addition, signs have been erected at a number of lakes to discourage recreational disturbance, and several presentations have been delivered to cottage and landowners at important plover lakes.

The distributions of potentially suitable (when unvegetated) substrates at ten key Piping Plover lakes (Little Fish, "Rider", Killarney, Reflex, Handhills, Dowling, Chappice, Chain Lakes "#4", Sam, and Rockeling Bay) have been mapped by AEP, Resource Information Branch. Hydrology of four particularly important lakes (Dowling, Handhills, Chappice, "Reflex West") have been modelled by AEP - Water Resources (DeBoer 1995). Basin contours and water balances will be used to develop a "Piping Plover Habitat Supply Model" for each of these lakes. These models will allow managers to predict the quantity of habitat at particular lakes both in a given year and over many years. They will allow managers to make better decisions as to the kinds of habitat management and population management strategies to employ at particular lakes. They will also facilitate interpretation of census results by allowing managers to quantify changes in habitat suitability and attractiveness.

In addition to these Alberta-based activities, the Western Hemisphere Shorebird Reserve Network (WHSRN) accepted Little Fish Lake to its Piping Plover registry in 1994 and Beaverhill Lake was designated a WHSRN site in May 1996. AEP and Alberta Conservation Association (ACA) completed an "Alberta Wildlife Status Report" on Piping Plover (Prescott 1997).

Discussion

The 1996 census resulted in a count of 276 adult Piping Plovers in Alberta. This is quite similar to Wershler and Wallis's (1987) count of 288 adults, but considerably higher than the 180 adults recorded for the 1991 census (Hofman 1994). This increase in 1996 resulted from both greater plover numbers on lakes inventoried in both 1991 and 1996 (28 more adults - Table 2) plus 68 adults found on 11 of 58 lakes which were inventoried in 1996 but not in 1991. The additional 28 adults found on lakes inventoried in both 1991 and 1996 constitutes a 15.6% increase. The corresponding comparison for lakes inventoried in both 1986 and 1996 is a decrease of 24% or a 4.2% overall decrease (Table 3). It is important to note that both comparisons are influenced heavily by dramatic increases at Dowling Lake and Handhills Lake. Habitat conditions and plover numbers both increased dramatically from 1995 and 1996 at these two lakes (J.P. Goossen, pers. comm.).

Some personnel involved in the 1996 census may have become more proficient at observing plovers during the five years between the two censuses. However, it is unlikely that this had a substantial effect on census results. All lakes that supported high numbers of plovers were censused by very experienced personnel in both censuses.

Only a few of the lakes that supported plovers in 1996 and were not censused in 1991 are thought to have supported plovers during the 1991 census. Water level fluctuations at these few lakes (Akasu Lake, the "Arvid Project", and Birch Lake) indicate that suitable habitat was exposed in 1991 and hence it is likely that plovers were present then. On lakes such as

Muriel, Beaverhill and others, new habitat was recently exposed by falling water levels and so it is unlikely that Piping Plovers utilized these sites in 1991.

Although every effort was made to census all waterbodies with known potential to support Piping Plover in 1996, it is likely that some smaller lakes were missed because they were not familiar to inventory personnel. For example, Albert Lake (near Vermilion) was not included in the initial list to be censused in 1996, however a volunteer was interested in censusing additional sites and so it was added to the list and two plovers were found. The western portion of the Aspen Parkland Ecoregion contains many additional wetlands with some potential. Over the next five years, we recommend that efforts be made to inventory these lakes for potential Piping Plover habitat.

The interpretation of single Piping Plover observations during the 1996 census deserves discussion. The census period (June 1-16) overlaps with the period of egg laying and incubation (Heckbert 1994, Heckbert and Cantelon 1990, Whyte 1985). It is likely that at least some plovers were on nests and were missed during counting. This is especially likely as little effort was put into locating nests (as per census protocol). Unfortunately, we have no means of knowing how many of the 58 "unpaired" plovers observed in this census had a mate sitting on a nest. Likewise, we are unable to estimate how many of these "unpaired" individuals were actually paired to others among the 58. If some of this group (say 19 for purpose of calculation) had unobserved mates sitting on nests, the population estimate would increase to 295.

In prairie environments, nesting habitat normally occurs on gravel beaches with sparse vegetation (Dundas 1995, Prindiville-Gains and Ryan 1988, Wershler and Wallis 1987, Whyte 1985). Results from this census are consistent with those of the above prairie investigators. Characteristics of lakes that supported plovers included gravel beaches with sparse or no vegetation, beaches widths usually greater than 10 m in width and alkali deposits. Given that basic characteristics of lakes with suitable plover habitat have been verified for Alberta, this information can be applied to identify additional lakes with potential for Piping Plovers.

It is obvious from this investigation that not all lakes with potential for Piping Plover are suitable for plover use in any given year. More than 50 Alberta lakes have supported Piping

Plovers (J. P. Goossen, pers. comm., Prescott 1997) but only 31 supported Piping Plover in 1996. This is not surprising given variations in lake water levels and consequent changes in habitat suitability. For example, continued low water levels at "Rider Lake", Little Fish Lake and Rockeling Bay has resulted in Piping Plover habitat being left some distance from the water and in severe vegetation encroachment. At other lakes, including Muriel and Beaverhill, recent water level declines have exposed suitable gravels creating ideal unvegetated habitat for Piping Plovers. Likewise, higher water levels may increase or decrease the amount of suitable habitat. Increased amounts of water at Dowling and Handhills lakes in 1996 (compared to 1991) resulted in more water being located near suitable gravels. As an apparent result, the numbers of Piping Plover increased at these lakes from 1991 to 1996. However, higher water levels at Spiers Lake in 1996 resulted in flooding of traditional habitat and no plovers were found there. Alberta is fortunate in having a diversity of wetlands which are utilized by plovers in varying circumstances. The natural process of habitat rejuvenation renders most lakes unusable in some years. The value of lakes which are currently in a phase of limited use for plovers (due to either low or high water levels) should not be underestimated. With time, they will again be suitable, and others which are currently suitable will be of limited or no use. Work conducted by AEP (Resource Information Branch) (R. Wells, pers. comm.) which relates location of gravel deposits and water balances to lake contours will help managers understand relationships between water levels, location of suitable gravels and habitat value to Piping Plovers. It is apparent that Piping Plovers demonstrate both site fidelity and the ability to disperse and use new habitat as it becomes available (Haig and Oring 1988 a,b).

A wide variety of disturbances have been noted on Piping Plover beaches, both in this census, and in previous investigations (Wershler and Wallis 1987, Wershler 1992). While these disturbances undoubtedly influence Piping Plover populations, it is apparent that water level fluctuations exert much greater influence. Global environmental changes, widespread land use changes and water consumption, diversion and stabilization have the potential to alter natural water level fluctuations. Snow melt and spring runoff are occurring earlier each year. In fact, the date at which spring runoff is 75% complete is now 23 days earlier than it was in 1963 (H. Cutforth, pers. comm.). These factors may have serious implications for the natural lake water level fluctuations that historically rejuvenated Piping Plover habitat in the Northern Great Plains.

Good progress has been made in dealing with site-specific disturbances in Alberta as outlined in this paper and in Prescott (1997). However, considering that less than 60 lakes in Alberta have been known to be used by Piping Plovers and that some of these are unavailable for use at any given time (due to natural water level fluctuations) it is very important that negative influences on habitats be minimized. Continued attention in this area and a far better understanding of the hydrology of key lakes are essential if we are to keep Piping Plover on traditional areas and achieve recovery plan goals (Goossen et al. 2002).

Acknowledgements

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Figure 1. Location of sites censused in Alberta during the 1996 International Piping Plover Census (adapted from Plissner and Haig 1997).

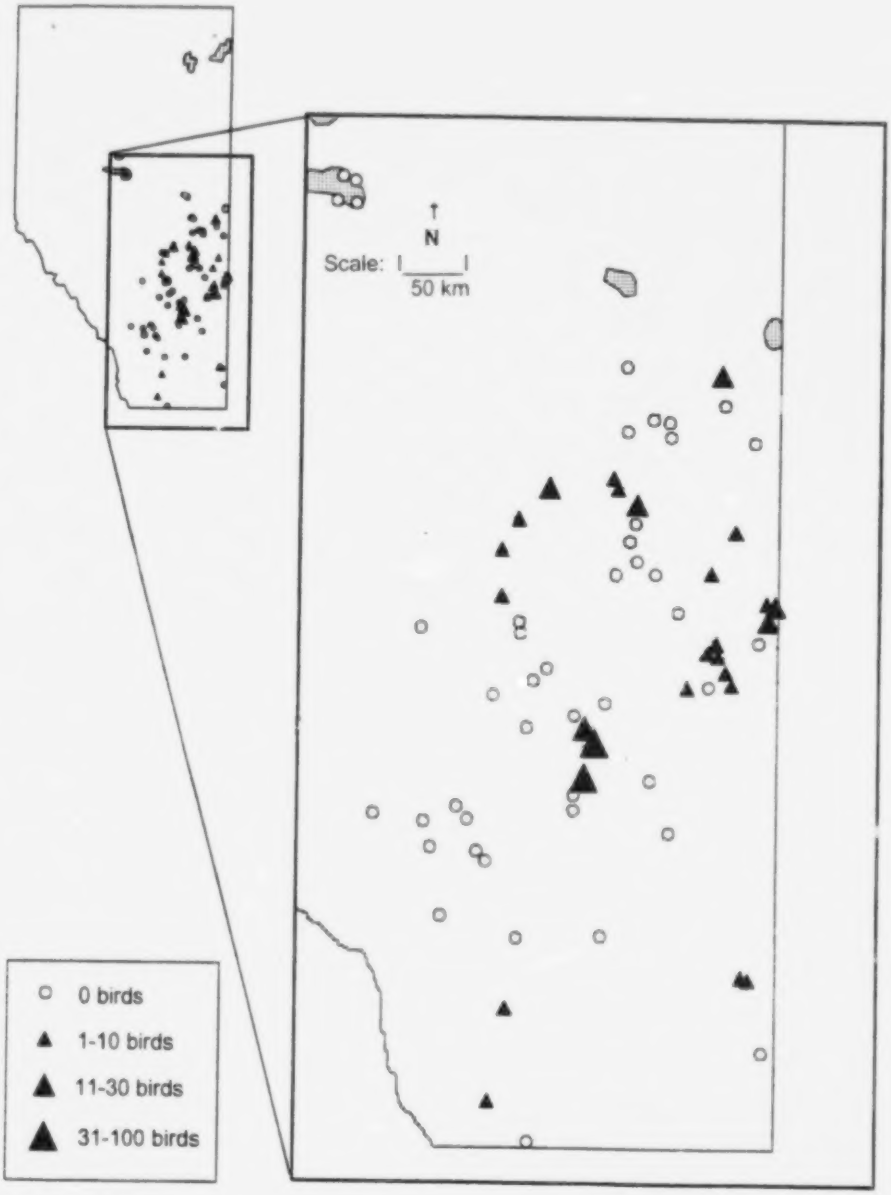
N
Scale:
50 km
○ 0 birds
▲ 1-10 birds
▲ 11-30 birds
▲ 31-100 birds

Table 1. Locations and numbers of Piping Plovers found in Alberta in 1996.

Date	Map sheet	Site	UTM[a]	Distance covered (km)	No. of observers	No. of adults	No. of pairs	% habitat covered
31 May	73E/5	Junction Lake	12U 449916x5922421	-	2	2	1	100
31 May	73E/14	Lake Eliza	12U 487925x5961069	9.6	2	0	0	100
31 May	73E/14	Lac St. Cyr	12U 486858x5972198	6.4	2	0	0	100
31 May	73 L/5	Bunder Lake	12U 454581x6015328	2.0	2	0	0	100
1 June	73E/5	Akasu Lake	12U 447487x5923261	12.0	2	10	5	100
1,2 June	72M/12,13, 82P/9,16	Dowling Lake	12U 419207x5738992	41.0	1	54	20	99
1 June	83H/6	Joseph Lake	12U 370202x5906918	8.0	3	0	0	100
1 June	82P/8	Little Fish Lake	12U 414171x5692985	8.8	1	0	0	100
1 June	83H/6, 7	Oliver Lake	12U 363658x5905481	~16.1	2	0	0	100
1, 6, 7 June	83H/2, 7	Miquelon Lakes "#3" (main lake)	12U 373343x5902779	2.4	2	0	0	100
1, 13 June	83H/2	Miquelon Lakes "#1"	12U 690025x5899217	3.2	1	1	0	-
2 June	82P/8	Antelope Lakes	12U 412914x5680817	5.6	1	0	0	50
2 June	73D/2	Gooseberry Lake	12U 519101x5769246	8.0	2	0	0	100
2 June	73D/9	"Reflex Lake" west of 4th meridian	12U 567628x5835443	-	2	19	7	100
3 June	73D/15	Baxter Lakes	12U 516918x5863038	7.0	1	2	1	100
3 June, 5 July	82P/16	Chain Lakes "#4"	12U 419207x5738992	8.5	3	13	6	100
3 June	82P/16	Chain Lakes "#5"	12U 419500x5741500	0.0	2	0	0	100
3 June	82P/16	Chain Lakes "#6"	12U 418500x5743835	-	2	0	0	100
3 June	82P/16	Chain Lakes "#7"	12U 417685x5745493	-	2	0	0	100
3 June	82P/16	Chain Lakes "#8"	12U 416085x5747138	-	2	0	0	100
3 June	82P/16	Chain Lakes ("#3A")	12U 422452x5738126	2.4	2	0	0	100
3 June	72L/1	Chappice Lake	12U 545545x5557259	6.5	2	1	0	100
3 June	73D/2	Foster Lake (31-37-4-W4)	12U 529418x5785293	6.4	2	2	0	100
3 June	73D/1, 2	"Greenlee Lake"	12U 531054x5783684	2.4	2	2	1	100
3 June	83A/3	Hummock Lake	12U 350284x5768631	5.6	1	0	0	100
3 June	82P/4	Janet Lake	12U 298930x5655371	1.7	2	0	0	100
3 June	73D/9	Killarney Lake	12U 560981x5826084	-	2	23	11	100
3 June	82P/4	McDonald Lake	12U 296232x5675891	4.1	2	0	0	100

Table 1. continued

Date	Map sheet	Site	UTM[a]	Distance covered (km)	No. of observers	No. of adults	No. of pairs	% habitat covered
3 June	83H/2	Miquelon Lakes "#2"	12U 376533x5900271	6.4	1	0	0	40
3 June	83A/10	"Rider Lake"	12U 380165x5821609	6.0	1	0	0	100
3 June	72L/1	Sam Lake	12U 553165x5555577	10.0	2	2	1	100
3 June	73E/4	Thomas Lake	12U 454100x5884600	-	2	0	0	100
3 June	73D/13	Whitewater Lake	12U 446660x5856933	0.8	2	0	0	100
3, 4, 6 June	83H/7, 8, 9,10	Beaverhill Lake	12U 408274x5914142	-	3	13	6	-
3, 6 June	82P/8, 9	Handhills Lake	12U 422420x5701902	-	1	54	20	100
3, 6, 7 June	73E/5	Birch Lake	12U 467623x5903474	16.0+	5	14	5	-
4 June	73E/16	Christopher Lake	12U 549692x5957090	5.6	2	0	0	100
4 June	82O/1, 8	Cochrane Lake	11U 675661x5679869	3.8	2	0	0	100
4 June	73L/2	Garnier Lakes	12U 526652x5986041	1.6	2	0	0	100
4 June	73D/8	Gillespie Lake	12U 553413x5811396	10.0	1	0	0	100
4, 11 June	83A/5, 12, 83 B/8, 9	Gull Lake	12U 297622x5818507	~46.2	2	0	0	100
4 June	73E/4	Lac Letendre	12U 460927x5881482	4.0	1	0	0	100
4 June	83A/10	"Lake 13" (Oberg Property) 17,20-41-20-W4	12U 374513x5821750	5.0	1	0	0	100
4 June	83A/10	"Messner Pond"	12U 371132x5824122	10.0	1	0	0	100
4 June	73D/7	"Metiskow Lake"	12U 524084x5807927	0.5	2	2	1	50
4 June	82P/15	Mudspring Lake	12U 378533x5741429	3.0	1	0	0	-
4, 8 June	73L/2	Muriel Lake	12U 518101x5997333	32.5	2	17	8	100
4 June	73D/2	"Neutral Hills Lakes ("A" unnamed)" 4-36-7-W4	12U 503414x5767401	4.8	2	0	0	100
4 June	73D/2	"Neutral Hills Lakes ("C1" unnamed)" 27-36-7-W4	12U 501780x5773875	6.4	2	5	1	100
4 June	82P/16	Pearl Lake (Chain Lake #1)	12U 424044x5735678	5.6	1	0	0	100

Table 1. continued

Date	Map sheet	Site	UTM[a]	Distance covered (km)	No. of observers	No. of adults	No. of pairs	% habitat covered
4 June	73D/7	"Piper Lake" (unnamed in 1991) 2,3-39-5-W4	12U 525300x5797200	3.0	2	6	3	100
4 June	72E/9	Reesor Lake	12U 564140x5500794	3.0	1	0	0	100
4 June	83A/10	Rockeling Bay (Buffalo Lake)	12U 377950x5823518	9.0	1	0	0	100
4 June	73D/7	Sunken Lake	12U 524000x5802500	5.0	2	7	3	100
4 June	83A/7	Unnamed (Bar Harbour Church Camp) 34-40-20-W4	12U 378239x5815842	0.8	2	0	0	100
4 June	72L/1	Unnamed Lake Southeast of Sam Lake 33-13-2-W4	12U 555343x5552495	6.5	1	0	0	100
4 June	83A/7	Unnamed Lake (East of Bar Harbour in '91 Census)	12U 379084x5816626	0.4	2	0	0	25
-	83O/7	Lessser Slave Lake	11U 601290x6147052			-	-	100
4 June	83O/7	-Prov. Park - Devonshire Beach	-	4.0	3	0	0	100
4 June	83O/7	-Prov. Park - Lilly Lake Group Use Beach	-	1.6	3	0	0	100
4 June	83A/6, 7, 10, 11	Buffalo Lake	12U 372590x5817605	6.4	1	0	0	-
5 June	83O/7	-Prov. Park Marten River Campground Beach	-	4.0	3	0	0	100
5 June	83O/7	-Nine Mile Point	-	0.4	2	0	0	100
5 June	73E/4	Carrier Lake	12U 462583x5882466	2.2	1	0	0	100
5 June	82P/4	Chestermere Lake	12U 302832x5657959	2.4	1	0	0	20
5 June	73D/9	Cipher Lake	12U 562500x5837000	3.0	2	4	2	100
5 June	82P/3, 82 I/14	Eagle Lake	12U 336865x5650291	4.8	1	0	0	20

Table 1. continued

Date	Map sheet	Site	UTM[a]	Distance covered (km)	No. of observers	No. of adults	No. of pairs	% habitat covered
5 June	73L/5	Floatingstone Lake	12U 457761x6007203	2.0	2	0	0	100
5 June	73E/13	Lac Brosseau	12U 456125x5964968	2.0	2	0	0	100
5 June	73D/9	Leane Lake	12U 329508x5674831	2.5	2	1	0	100
5 June	73L/5	Reed Lake	12U 451132x6011381	3.0	2	0	0	100
5 June	82H/2	Shanks Lake	12U 372952x5435450	-	1	0	0	-
5 June	73D/11	Wilkins Lake	12U 498993x5826278	5.0	1	0	0	100
5, 6 June	83A/10,11,14	Red Deer Lake	12U 360668x5851807	25.0	1	2	1	100
6 June	73 E/4, 5	Alice Lake	12U 462709x5898653	-	2	0	0	100
6 June	83 A/3	Goosequill Lake	12U 361375x5767702	~8	2	0	0	100
6 June	73 D/13	Hattie Lake	12U 460051x5868030	2.0	1	0	0	100
6 June	73 E/4	Lac Deroches	12U 464248x5877748	3.0	1	0	0	100
6 June	72 L/5	Lake Newell	12U 429848x5585068	60.0	4	0	0	100
6 June	83 A/2	Lonepine Lake	12U 404187x5786125	11.3	2	0	0	100
6 June	82 P/3	Long Lake (east of Bruce Lake) 9,16-26-25-W4	12U 329508x5674831	1.0	1	0	0	40
6 June	73 E/14	Lower Therien Lake	12U 476273x5976312	2.0	2	0	0	100
6 June	82 I/14	Namaka Lake	12U 341565x5643665	2.0	1	0	0	20
6 June	73 D/2	"Neutral Hills Lakes ("B1" unnamed)" 9-36-7-W4	12U 503413x5769019	6.4	1	2	1	100
6 June	73 D/2	"Neutral Hills Lakes ("B2" unnamed)" 16,17-36-7-W4	12U 503412x5770638	4.0	1	0	0	100
6 June	82 P/5	"Salt Lake Reservoir" (Unnamed lake near Irricana)	12U 323063x5684753	4.0	1	0	0	20
6 June	73 D/2	Sounding Lake	12U 534340x5778850	4.8	2	2	0	100
6 June	82 P/16	Spiers Lake	12U 414542x5752022	4.8	1	0	0	100
6 June	73 D/14	Unnamed lake 11-45-10-W4	12U 476238x5856592	3.0	1	0	0	100

Table 1. continued

Date	Map sheet	Site	UTM[a]	Distance covered (km)	No. of observers	No. of adults	No. of pairs	% habitat covered
6 June	73 D/13	Vernon Lake	12U 464924x5867992	4.0	1	0	0	100
6,7 June	73 E/4	Camp Lake	12U 464239x5885691	3.5	3	0	0	100
7 June	82 I/12	Frank Lake	12U 308338x5604287	7.0	1	0	0	20
7 June	73 D/7	Horseshoe Lake	12U 517587x5799806	7.0	2	6	2	100
7 June	82 H/14, 15	Keho Lake	12U 356476x5534721	20.0	2	1	0	100
7 June	83 A/2	Lowden Lake	12U 384451x5776830	9.7	1	0	0	100
7 June	72 M/3	Majors Lake	12U 488708x5662286	-	5	0	0	-
7 June	82 I/7, 10	McGregor Lake	12U 366517x5592768	68.0	2	0	0	100
7 June	73 E/4	Oliva Lake	12U 459304x5880874	1.5	1	0	0	100
7 June	72 M/16	Plover Lake	12U 478433x5706023	15.0	5	0	0	90
8 June	73 D/9	"Arvid Project"	12U 559736x5827659	-	2	2	1	100
8 June	73 D/9	Dillberry Lake	12U 566627x5826158	-	2	0	0	100
9 June	82 H/6	St. Mary Reservoir	12U 342585x5466551	-	1	3	1	-
10 June	82 P/16	Clear Lake (Chain Lakes "#3")	12U 420810x5737347	3.0	1	0	0	100
12, 13 June	72 M/13, 73 D/4, 82 P/16, 83 A/1	Sullivan Lake	12U 431544x5748522	32.2	3	0	0	60
14 June	73 E/1	Albert Lake	12U 535985x5890549	5.0	1	2	0	100
14 June	83 H/3	Bittern Lake	11U 541224x5623606	20.0	2	2	1	100
27 June	83 A/7	Jackknife Lake ("Stinky Lake") 36-40-20-W4	12U 380693x5815782	-	3	0	0	5
Totals		103				276	109	

[a] UTM = Universal Transverse Mercator Grid.

Table 2. Comparison of 1991 and 1996 Piping Plover population counts in Alberta.

Site	1991 census		1996 census		Change	
	No. of adults	No. of pairs	No. of adults	No. of pairs	No. of adults	No. of pairs
Baxter Lakes	2	1	2	1	0	0
Buffalo Lake	0	0	0	0	0	0
Pearl Lake (Chain Lakes "# 1")	2	1	0	0	-2	-1
Clear Lake (Chain Lakes "# 3")	2	1	0	0	-2	-1
Chain Lakes "#4"	5	2	13	6	8	4
Chain Lakes "#6"	2	1	0	0	-2	-1
Chain Lakes "#7"	0	0	0	0	0	0
Chain Lakes "#8"	0	0	0	0	0	0
Chain Lakes "#3A"	0	0	0	0	0	0
Chappice Lake	2	1	1	0	-1	-1
Cipher Lake	4	2	4	2	0	0
Dowling Lake	21	7	54	20	33	13
Foster Lake (31-37-4-W4)	0	0	2	0	2	0
Gillespie Lake	0	0	0	0	0	0
Gooseberry Lake	9	4	0	0	-9	-4
Goosequill Lake	0	0	0	0	0	0
"Greenlee Lake"	4	2	2	1	-2	-1
Handhills Lake	20	7	54	20	34	13
Horseshoe Lake	0	0	6	2	6	2
Keho Lake	3	1	1	0	-2	-1
Killarney Lake	22	8	23	11	1	3
Lake Newell	1	0	0	0	-1	0
Leane Lake	2	1	1	0	-1	-1
Lesser Slave Lake-4 sites [a]	0	0	0	0	0	0
Little Fish Lake	19	8	0	0	-19	-8
Lonepine Lake	0	0	0	0	0	0
Lowden Lake	0	0	0	0	0	0
McDonald Lake	0	0	0	0	0	0
"Messner Pond"	0	0	0	0	0	0
"Metiskow Lake"	2	1	2	1	0	0
Miquelon Lakes "#3" (main lake)	0	0	0	0	0	0
Miquelon Lakes "#2"	0	0	0	0	0	0
"Neutral Hills Lakes" ("A" unnamed) 4-36-7-W4	2	1	0	0	-2	-1
"Neutral Hills Lakes" ("B1" unnamed) 9-36-7-W4	0	0	2	1	2	1
"Neutral Hills Lakes" ("B2" unnamed) 16,17-36-7-W4 "	0	0	0	0	0	0
"Neutral Hills Lakes" ("C1" unnamed) 27-36-7-W4	5	1	5	1	0	0
"Piper Lake" (unnamed in 1991) 2,3-39-5-W4	12	4	6	3	-6	-1
"Reflex Lake" W4	12	4	19	7	7	3
"Rider Lake"	7	3	0	0	-7	-3
Rockeling Bay (Buffalo Lake)	6	3	0	0	-6	-3
Sam Lake	4	2	2	1	-2	-1
Sounding Lake	0	0	2	0	2	0
Spiers Lake	2	1	0	0	-2	-1

Table 2. (continued)

Site	1991 census		1996 census		Change	
	No. of adults	No. of pairs	No. of adults	No. of pairs	No. of adults	No. of pairs
Sunken Lake	8	3	7	3	-1	0
Unnamed lake east of Bar Harbour 35-40-20-W4	0	0	0	0	0	0
Unnamed lake Southeast of Sam Lake 33-13-2-W4	0	0	0	0	0	0
Totals	180	70	208	80	+28 (116%)	+10 (114%)

[a] The four sites surveyed at Lesser Slave Lake were: Nine Mile Point, Prov. Park – Marten River Campground Beach, Prov. Park – Devonshire Beach, and Prov. Park – Lilly Lake Group Use Beach.

Table 3. Comparison of 1986 and 1996 Piping Plover numbers in Alberta.

Site [a]	1986	1996	Change
Baxter Lakes	0	2	2
Beaverhill Lake	0	13	13
Bittern Lake	0	2	2
Buffalo Lake	2	0	-2
Clear Lake	1	0	-1
Chain Lakes "#4"	12	13	1
Chain Lakes "#6"	1	0	-1
Chappice Lake	17+	1	-16
Cipher Lake	4	4	0
Dowling Lake	18	54	36
"Foster Lake" (unnamed 31-4-W4)	6	2	-4
Frank Lake	0	0	0
Gooseberry Lake	4	0	-4
Goosequill Lake	2	0	-2
"Greenlee Lake"	3	2	-1
Gull Lake	0	0	0
Handhills Lake	37	54	17
Horseshoe Lake	2	6	4
Killarney Lake	(0)[b]	23	23
"Lake 13" ("Unnamed lake, N. of Buffalo Lake")	0	0	0
Lake Newell	3+	0	-3
Large pond E. of Bruce Lake	1	0	-1
Little Fish Lake	23	0	-23
Lowden Lake	0	0	0
"McDonald Lake"	0	0	0
Miquelon Lakes "#2"	0	0	0
Miquelon Lakes "#3"	0	0	0
Neutral Hills Unnamed lake "A"	12	0	-12
Neutral Hills Unnamed lake "B1"	4	2	-2
Neutral Hills Unnamed lake "B2"	0	0	0
Neutral Hills Unnamed lake "C1"	6	5	-1
Oliver Lake	0	0	0
"Piper Lake" ("Unnamed 39-5-W4")	15+	6	-9
"Reflex Lake West"	46+	19	-27
"Rider Lake"	15	0	-15
Rockeling Bay (Rockland Bay)	18	0	-18
Sam Lake	6+	2	-4
Sounding Lake	18+	2	-16
Spiers Lake	6	0	-6
Sunken Lake	5+	7	2
Unnamed lake SE of Sam Lake	1	0	-1
Totals	288	219	-69 (-24%)

[a] Names in () are from Wershler and Wallis (1987).

[b] Wershler and Wallis (1987) did not actually inventory this lake but they did inspect it, and concluded that there was no suitable habitat because of a high water level.

Table 4. Numbers[a] of lakes with various physical attributes according to categories (Piping Plover numbers).

	Subjective habitat suitability			Gravel		Mean beach width			Shoreline consistency		Salt deposits		
Lake category	**Unsuitable**	**Marginal**	**Good**	**Absent**	**Present**	**<10 m**	**10-30 m**	**>30 m**	**Soft**	**Firm**	**Absent**	**Localized**	**Extensive**
Principal (5^+ Piping Plovers)	0	1	12	0	11	3	3	3	2	9	2	3	6
Secondary (1-4 Piping Plovers)	3	7	6	1	14	6	6	3	6	10	3	6	6
Unoccupied (0 Piping Plovers)	36	32	6	23	29	53	12	3	22	23	27	29	11

[a] Not all censusers responded to all questions and not all responses were usable. The total number of lakes rated for the above characteristics varied from 72 (Shoreline consistency) to103 (Subjective habitat suitability).

Table 5. Threats[a] to Piping Plover habitat at principal, secondary and unoccupied lakes.

Lake category	Water shortage[b]	Vegetation encroachment	Disturbance N = 11, 12, 63[c]				
	N = 13, 16, 72[c]	N = 12, 15, 67[c]	Livestock	Humans on foot	Vehicles	Industrial & Misc.	None
Principal lakes (>4 Piping Plovers) Total N = 13[c]	8 (4)[d]	11	9	2	3	0	2
Secondary lakes (1-4 Piping Plovers) Total N = 18[c]	8	9	10	1	1	1	1
Unoccupied lakes (0 Piping Plovers) Total N = 72[c]	17	50	44	14	4	7	10

[a] Inundation is not included in this table. It could affect nearly all of the lakes censused (see text).

[b] Censusers were asked to categorize water levels as High, Normal or Low. Lakes with "Low" water levels were considered threatened by water shortage.

[c] Sample sizes across the top of the table are the number of lakes in each category (principal, secondary or unoccupied) for which censusers responded. Sample sizes in the left hand column are the total number of lakes that supported the specified range of Piping Plover numbers.

[d] Censusers reported "Normal" or "High" water levels at Dowling, Handhills, Horseshoe and Sunken lakes. These four lakes were still regarded as threatened by water shortage as they could easily be dry within five years.

2.10 The 1996 international Piping Plover breeding and winter censuses in the United States, Mexico, and the Caribbean

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Abstract

The 1996 International Piping Plover Census was conducted throughout the known breeding and wintering ranges of the species in order to determine the current status and distribution of the species and to provide an initial range-wide assessment of the results of recovery efforts. The winter portion of the census covered coastlines of eight U.S. states, Puerto Rico, the Bahamas, Cuba, and Tamaulipas, Mexico. A total of 2515 wintering birds were tallied, 27.1% fewer than reported during the first international census in 1991. Numbers of wintering birds were substantially higher than in 1991 along the Atlantic Coast, but decreased in Gulf Coast regions. A majority of wintering Piping Plovers were observed along the Texas coast, particularly in the Laguna Madre region. The total observed represented less than half of the population recorded during the subsequent breeding season, indicating that additional wintering areas remain to be found. Some areas like Laguna Madre in Texas and Mexico need to have more effective coverage.

In the U.S., the breeding portion of the census included coverage of suitable habitat in 20 states. The Atlantic Coast population consisted of 2169 adults, an increase of 48.4% since 1991, indicative of the success of recent management efforts. The Great Lakes population increased 17.5% to 47 birds. In the U.S. Great Plains, however, 1599 adults represented a 21.3% decline since 1991 and resulted largely from low numbers along the major river systems. Overall, the U.S. breeding population was 8.0% higher than in 1991, but the census clearly demonstrated the importance of assessing the status of the species at finer spatial scales as well as the need to understand the interactions between populations and among different regions within populations.

Résumé

Le recensement international des pluviers siffleurs de 1996 a été effectué dans l'ensemble des aires de nidification et d'hivernage de l'espèce afin de déterminer l'état actuel et la distribution de la population et pour estimer les retombées des efforts produits en faveur du rétablissement de l'espèce. La partie hivernale du recensement portait sur les rivages de huit États américains, de Puerto Rico, des Bahamas, de Cuba et de Tamaulipas, au Mexique. Au total, 2515 oiseaux ont été enregistrés sur leur lieu d'hivernage, soit 27,1 % de moins que lors du premier recensement international de 1991. Sur la côte Atlantique, les effectifs des oiseaux sur leurs aires d'hivernage étaient plus élevés que lors du recensement de 1991 mais la tendance était inversée dans les régions côtières du golfe du Mexique. La majorité des pluviers siffleurs ont été observés le long de la côte du Texas, en particulier dans la région de la Laguna Madre. L'effectif total observé représente moins de la moitié de la population enregistrée lors de la saison de nidification suivante, ce qui indique que des aires d'hivernage utilisées par les oiseaux échappent encore aux recensements. Quelques secteurs tels que la Laguna Madre, au Texas, et plusieurs sites au Mexique méritent d'être mieux explorés.

Aux États-Unis, la partie du recensement portant sur la nidification a visé 20 États. La population sur la côte atlantique était composée de 2169 oiseaux adultes, soit une augmentation de 48,4 % depuis 1991, ce qui traduit le succès des récents efforts de gestion dans la région. La population des Grands lacs a augmenté de 17,5 % et est passé à 47 oiseaux. Dans les grandes plaines des États-Unis, cependant, l'effectif des adultes (1599) traduit un déclin de 21,3 % depuis 1991 et est essentiellement le fait de faibles densités le long des principaux fleuves. Globalement, la population des oiseaux nicheurs aux États-Unis était de 8,0 % supérieure à ce qu'elle était en 1991, mais le recensement montre clairement l'importance d'évaluer le statut de l'espèce à une échelle plus petite ainsi que le besoin de comprendre les interactions entre les populations et entre les différentes régions à l'intérieur des populations.

Introduction

Monitoring programs are key elements of the Canadian and U.S. recovery plans for Piping Plovers (Atlantic and the Prairie Piping Plover Recovery teams 1989; U.S. Fish and

Wildlife Service 1988, 1994, 1996). The 1996 International Piping Plover Census was the second thorough survey of population numbers across the entire range of the species, and thus provided the first opportunity for analysis of overall trends in abundance. The census provided additional opportunity to expand knowledge of the distribution of Piping Plovers during both breeding and wintering periods and to examine evidence for contraction or expansion of ranges since the first international census, conducted in 1991. The extensiveness of the effort provides opportunities to assess current conservation needs and the success of previous and ongoing management efforts for the species, both at local levels and in context with larger scale population demographics. This paper focuses upon the results of the census from outside Canada, including all results of the winter portion of the 1996 International Piping Plover Census.

Methods

Guidelines for conducting the 1996 International Piping Plover Census followed those adopted for the first international census in 1991 (Haig and Plissner 1993, 1994). The winter census was conducted during or as near as possible to the week of 15-21 January 1996 along the southeast Atlantic and Gulf coasts of the U.S., Puerto Rico, coastal Tamaulipas (Mexico), Cuba, and the Bahamas (Fig. 1). Key individuals in Jamaica, Bermuda, Dominican Republic, U.S. Virgin Islands, and the Mexican states of Yucatan, Sonora, and Sinaloa were also notified of the census and asked to provide information on any sightings during the time period. The breeding census was carried out across the species range primarily from 1-9 June 1996 (Fig. 1). In some regions of the Great Plains, aerial or ground assessments of water bodies were carried out prior to the census period in order to concentrate survey efforts on areas with suitable habitat. Along most of the Atlantic Coast and at some Great Lakes and Great Plains breeding areas, the 1996 International Piping Plover Census was incorporated as part of more extensive population monitoring efforts. In both breeding and winter censuses, prioritization of areas to be censused was based upon the occurrence of Piping Plovers at sites during the previous five years as well as the current and recent habitat suitability.

Census coordinators were chosen for 27 U.S. states, the Missouri River system, Mexico, and five West Indian nations and territories, in which the species is known or presumed to reside during the census periods. Individual censusers were subsequently provided with standard guidelines and datasheets and asked to conduct a single survey of designated sites within the census period. Observers were asked to provide information on numbers of plovers observed, census conditions and methods, general habitat characteristics, and any special features (e.g., bands or injuries) pertaining to the birds observed. Observers also were encouraged to submit maps of each site, indicating coverage and locations of birds. During the June portion of the census, additional information on pair status was requested, although active searching for nests and young was discouraged, in order to minimize disturbance levels. At all times, observers were to avoid conducting censuses during extreme weather conditions.

Results and Discussion

Winter census

Over 400 people participated in the winter portion of the 1996 International Piping Plover Census, covering more than 3300 km of shoreline along the southern U.S. Atlantic coast, the northern Gulf of Mexico, the Bahamas, and islands of the northern Caribbean. (Table 1, Fig.1). A total of 2515 birds was recorded from 129 sites throughout the winter range of the species, with the majority (53%) found along the Texas coast. Concentrations of 50 or more birds were observed in Texas, on the Louisiana barrier islands, and along the Gulf Coast of Florida. Wintering plovers were primarily associated with tidal flats composed of sand, mud, and/or algal substrates. Over half of the birds were associated with lagoons, bays, or other waterbodies protected from ocean conditions. Nearly 80% of the birds were found on or adjacent to barrier islands, while less than a quarter were found on ocean beaches.

The total number of wintering plovers reported initially suggests a decline of 27.1% from the 1991 tally. The number of winter birds recorded in 1996, however, represented only 42.5% of the number of adults observed the following June, indicating that the survey effort was far from comprehensive. In part, this deficit resulted from poor weather conditions and extremely low tides throughout the census period that hampered efforts in Louisiana and

Texas, the two states with the highest concentrations of wintering Piping Plovers. Many areas with suitable habitat, including over 100 sites that had 458 birds present in 1991, simply were not surveyed in 1996. Nevertheless, among areas similarly covered in both census years, plover numbers still declined by 25%. These decreases were attributed to declines occurring at sites along the Gulf Coast, because Piping Plover numbers increased by 67.9% along the Atlantic Coast and in the northern Caribbean. Census efforts in the Bahamas and in Cuba were much more extensive than those of 1991, resulting in a greater distribution of plovers (albeit fewer total birds) in the former and a substantial increase in numbers in the latter nation. A few birds were again located near channels separating the barrier islands of the Laguna Madre of Tamaulipas, Mexico; however, the vast expanse of potential habitat in the region remains largely unsurveyed. No birds were reported from elsewhere in the Caribbean or from Bermuda, where small numbers of Piping Plovers have been observed during the migration or winter period of each of the previous six years (D. Wingate, pers. comm., but see Mabee et al. 2001).

Perhaps as a result of difficulties in approaching Piping Plovers on the expansive tidal flats of the lower Texas coast, only eight banded individuals were reported during the winter census, all from the Atlantic and Florida Gulf coasts. Although banding efforts for Piping Plovers have generally declined in recent years, in 1995, 245 chicks in Saskatchewan received colour-band combinations in preparation for the international census, and 162 captive-reared fledglings were released along the Missouri River after being fitted with metal bands and blue plastic flags on their legs. None of these birds were reported from wintering areas in 1996. Smaller banding operations have also continued in recent years at Lake of the Woods, Minnesota and in Michigan. Details for six of the eight banded individuals seen during the winter census provided sufficient information to identify their sources. Three birds originated from Michigan, while two were banded on breeding grounds at Lake of the Woods or in North Dakota, up to 10 years earlier. The sixth banded plover was observed on Marco Island, Florida, in the vicinity where it was banded in 1988 (T. Below, pers. comm.).

Breeding census

In the United States, 375 individuals participated in the breeding portion of the 1996 International Piping Plover Census, surveying nearly 6000 km of relevant coastal, river, reservoir, and lake shorelines in 20 states. The census included coverage of virtually every water body and beach known to have had Piping Plovers present since the last international census. Areas surveyed in the U.S. included more than 1400 km of Atlantic coastline, 1500 river kilometres, 1900 km of major reservoir shoreline, 102.5 km of Great Lakes and Lake-of-the-Woods beaches, 208 smaller lakes, and 79 industrial ponds and pits.

Throughout the U.S. portion of the species' breeding range, 3815 Piping Plovers were recorded during the census period (Fig. 1, Table 2), an increase of 8.0% over 1991 totals. As in 1991, U.S. birds accounted for 64% of the total breeding population. The decline in numbers in the Great Plains, coupled with increases in the Atlantic population resulted in a reversal of the relative sizes of the two populations from 1991 numbers. In 1996, the majority of the U.S. birds 56.7% were found along the Atlantic Coast, with 42.1% in the Great Plains region, and just over 1% along the Great Lakes' shores (Michigan). Plover numbers in the Great Lakes region increased by 17.5% (7 birds), although the distribution of the species among lake beaches was basically unchanged from that of 1991.

In 1996, 83.4% of the breeding population of Atlantic Coast Piping Plovers was reported from the United States, an increase from 74% recorded in 1991. The greatest increases were reported from New England (200% in Maine and 199.3% in Massachusetts), while in the southern portion of the breeding range (Delaware to North Carolina), populations declined by 18.5% during the five-year period. Areas with the highest total numbers of Piping Plovers present in 1996 included Assateague Island National Seashore, Maryland (n = 91 birds); Sandy Hook National Recreation Area, New Jersey (n = 74); Crane Beach, Massachusetts (n = 66); South Beach - Chatham, Massachusetts (n = 64); and Westhampton Island West, New York (n = 58). The greatest concentration of Atlantic Coast plovers reported was that of Sandy Hook, New Jersey, with an average of 18.4 birds observed per kilometer of habitat surveyed.

Among mid-continent populations of Piping Plovers, national trends were opposite those of the Atlantic Coast. In 1991, 58.6% of the region's Piping Plovers were reported from the U.S., whereas in 1996, that number fell to 48.6%. Increases in numbers of birds were reported for Iowa and non-riverine wetlands of North Dakota. Declines continued at Lake of the Woods, Minnesota, and throughout the eastern portion of the region, threatening potential connectivity between Great Lakes populations and those further west. The Great Lakes population continued to increase slowly since the previous census, although there does not appear to be a significant expansion of the distribution, and the species appears to be extirpated from Wisconsin (S. Matteson, pers. comm.). As in 1991, the geographically isolated population of Piping Plovers in Colorado remained small and consisted of few breeding individuals. A nest along the Kansas River, however, provided the first breeding record for the species in Kansas (Busby et al. 1997).

Population trends in the Great Plains region varied in relation to habitat type. In 1996, numbers of Piping Plovers along the Missouri River and its tributaries (including the Platte and Niobrara rivers) were 50% lower than those reported in 1991, whereas numbers of birds at alkali lakes and other prairie water bodies were slightly higher (1%) in 1996. These changes shifted the habitat distribution of the birds in the region. In 1991, 44% of the U.S. Great Plains population was found along the major rivers and their reservoirs. In 1996, only 28% of the birds were associated with such habitats.

Implications of the 1996 International Piping Plover Census

Results of the 1996 International Piping Plover Census provided a valuable overview of the status and distribution of the species. The winter portion of the survey identified wintering locations of only 42.5% of the population reported during the subsequent breeding period. Although much of the difference may be attributed to incomplete survey effort within the area covered, it is clear that the wintering areas of a substantial proportion of the breeding population remain elusive and are likely to be found outside of the United States. The winter census, in comparisons with 1991 results, also reflected regional population trends on the breeding grounds, with increases along the Atlantic Coast and declines in Gulf Coast regions. While these data suggest a general pattern of longitudinal segregation of breeding populations on wintering grounds, the observations of banded birds reported here and elsewhere (e.g., Haig and Oring 1988b; Haig and Plissner 1993; F. Cuthbert, K. Drake, P. Goossen, S. Maxson, K. Mehl, L. Wemmer, pers. comm.) also demonstrate both that individuals from the same breeding population may migrate to different regions across the winter range of the species and that mixing of breeding populations occurs across most of the winter range.

It is clear from the results of the census that the Laguna Madre region of southwestern Texas remains the single most important region for wintering Piping Plovers and that this area requires particular attention for species conservation efforts. It is unclear, however, the extent to which the area is used by individuals from the Atlantic Coast breeding population. Recent hurricanes and winter storms have dramatically altered wintering habitat from Louisiana to the Florida Gulf Coast and is reflected by census results; however, the impact of such modifications on specific breeding populations or the species overall has not been determined. Such studies in conjunction with future censuses would be valuable both for understanding population responses to natural catastrophes and for predictions of impacts of human alteration of wintering habitat.

The breeding census results provided evidence for the success of management efforts for the species along the U.S. Atlantic Coast, but also demonstrated the need to consider population dynamics at various scales. Despite a substantial increase in numbers overall, the breeding population of the southern Atlantic states decreased since 1991, raising concerns that an increase in population numbers could potentially mask a corresponding shrinkage of the distribution. Trends in numbers of Great Lakes birds also raise the issue of a dissociation of population trends and changes in distribution (Plissner and Haig 2000b). A gradual increase in numbers of birds has not had a corresponding spread in the breeding range, despite apparently suitable habitat along both U.S. and Canadian shorelines. Increasing or maintaining a broad distribution lowers the risk of extinction by reducing the effects of local catastrophes on the overall population.

In the U.S. Great Plains, regional and habitat-related trends in abundance also demonstrated the need for addressing conservation issues at multiple spatial scales. The results indicated that individuals may shift between nesting habitats in response to annual fluctuations in habitat quality. Additional information on recoveries of banded individuals will be necessary to determine the validity of the hypothesis. Drought, flooding, and water management practices may all influence the breeding distribution of the entire Prairie Canada/U.S. Great Plains. Viability of the population, therefore, may be dependent upon the maintenance of various habitat types throughout the region, providing alternative nesting locations.

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Figure 1. Breeding and wintering distribution of Piping Plovers in the United States.

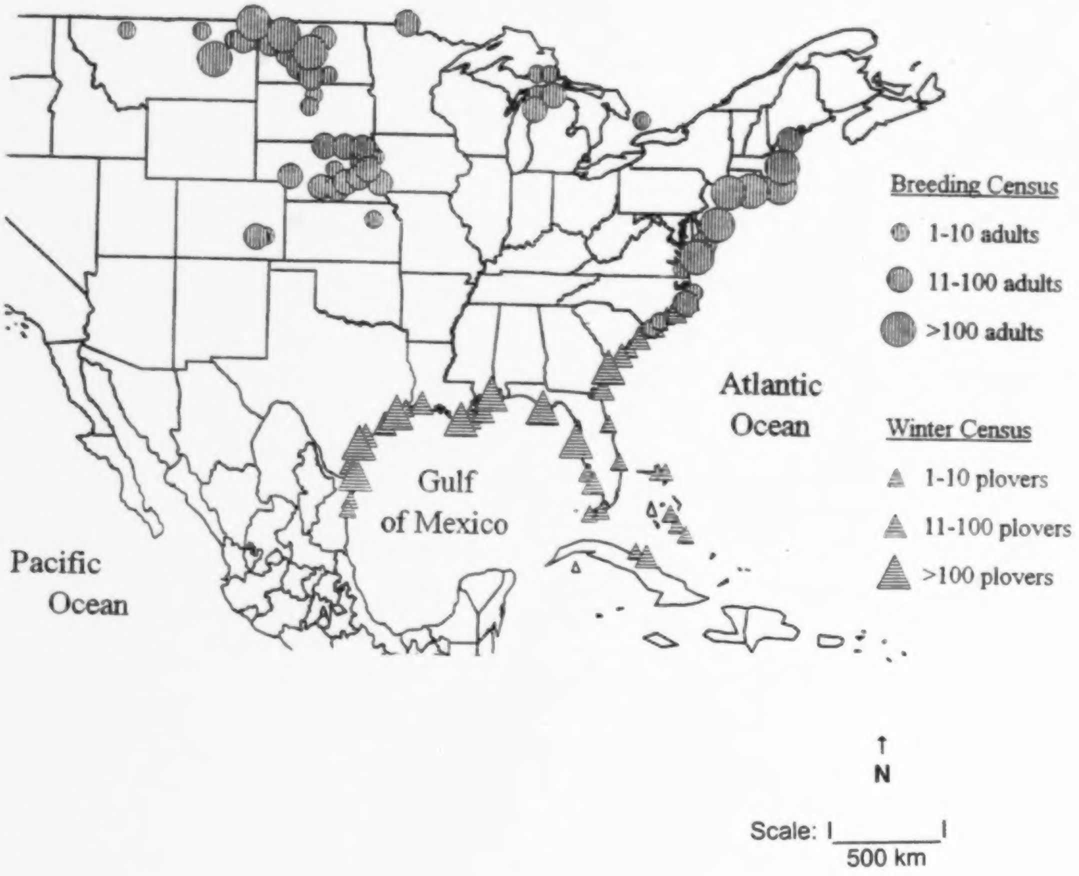
Atlantic Ocean
Gulf of Mexico
Pacific Ocean
Breeding Census
1-10 adults
11-100 adults
>100 adults
Winter Census
1-10 plovers
11-100 plovers
>100 plovers
N
Scale:
500 km

Table 1. 1996 International Piping Plover winter census summaries.

Location	Total no. Piping Plovers	% change from 1991	Total "sites" censused	Sites with Piping Plovers	Linear km surveyed	"New" sites (not surveyed 1991)	Sites with Piping Plovers in 1991 but not surveyed in 1996
United States	2416	-29	319	116	3197.7+	77 (20[a])	18 (394 [b])
(Atlantic Coast)	(283)	(+59)	(122)	(38)	(1161.8+)	(23 [5 [a]])	(0)
(Gulf Coast)	(2133)	(-33)	(194)	(78)	(2019.9+)	(52 [15 [a]])	(18 [394 [b]])
(Puerto Rico)	(0)	(0)	(3)	(0)	(16)	(2 [0 [a]])	(0)
Bahamas	17	-41	10	8	?	10 (8 [a])	(1 [29 [b]])
Cuba	66	+500	10	3	106.5+	9 (2 [a])	0
Tamaulipas, Mexico	16	-41	2	2	23	1 (1 [a])	3 (24 [b])
Atlantic/Caribbean	366	+68	145	49	1268.3+	42 (15 [a])	1(29 [b])
Gulf of Mexico	2149	-34	196	80	2058.9+	55 (16 [a])	21(418 [b])
Totals	2515	-27	341	129	3327.2+	97(31 [a])	22(447 [b])

[a] Sites with Piping Plovers.

[b] Number of adults in 1991.

Table 2. 1996 International Piping Plover breeding census summaries for the United States.

Location	Total no. adults	% change from 1991	Total no. breeding pairs	Total "sites" censused	Sites with Piping Plovers	Sites with pairs	Linear km surveyed
Atlantic Coast	2169	48.4	1078	413	237	231	1442.2
Maine	114	200.0	57	25	18	18	31.6
Massachusetts	877	199.3	437	126	82	82	370.1
Rhode Island	91	93.6	45	13	10	10	29.6
Connecticut	42	-37.3	20	19	7	6	20.9
New York	493	47.6	256	118	69	67	339.7
New Jersey	225	-19.6	103	43	23	22	135.6
Delaware	8	-20.0	4	17	2	2	59.2
Maryland	91	160.0	50	1	1	1	45
Virginia	155	-42.6	72	21	12	12	147.6
North Carolina	73	-15.1	34	30	13	11	262.8
Great Lakes	47	17.5	21	71	14	14	94.5
Michigan	47	20.5	21	59	14	14	94.5
Wisconsin	0	-100.0	0	12	0	0	0
Great Plains	1599	-21.3	698	422	213	180	4431.3
Missouri River[a]	187	-70.1	77	76	65	51	2513
Montana[b]	129	-54.3	52	68	22	18	430.7
North Dakota[b]	879	28.3	398	121	62	58	456.2
South Dakota[b]	0	-100.0	0	15	0	0	18.1
Nebraska[b]	366	-8.0	155	101	57	47	897.6
Iowa	14	7.7	7	2	2	2	2.4
Colorado	13	0.0	3	35	3	2	104.6
Kansas	1		1	1	1	1	0.7
Minnesota	10	-23.1	5	3	1	1	8
Totals	3815	+8.0%	1797	906	464	425	5968

[a] River sites in Montana, North Dakota, South Dakota and Nebraska.

[b] Counts not including Missouri River sites.

3.0 General Discussion

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Overview of the second International Piping Plover Census

The first global census of Piping Plovers was carried out in 1991, covering breeding and wintering habitats. A total of 5484 adults was counted on the Canadian and U. S. breeding grounds, however only about 63% of the breeding population was accounted for on the Mexican, U. S., Caribbean and Bahamian wintering grounds (Haig and Plissner 1993). The 1991 census provided biologists and wildlife managers with the first comprehensive assessment of the Piping Plover population, thereby assisting them in their future recovery planning and management activities.

In 1996, the second international census was carried out, again on both wintering and breeding grounds. The significance of this census was that it provided the first opportunity for biologists to assess whether or not regional and global populations had fluctuated significantly. The final breeding tally was 5931 adults and the total wintering count was 2515 plovers (Plissner and Haig 2000a). The Canadian Piping Plover breeding population increased by 8.4%, from the 1991 census (Plissner and Haig 2000a). Regionally, breeding Piping Plovers were found in two areas in Canada: Atlantic Canada/Québec and Prairie Canada (including Lake of the Woods, Ontario). Piping Plovers have been extirpated as a breeding species in Ontario's Great Lakes since 1977 (Lambert 1987). The increase in Canadian plover numbers came from Prairie Canada where that population increased by 17.4% (Plissner and Haig 2000a). Atlantic/Québec plover numbers declined however, by 17.1%. The increase in the prairie population has been attributed to a possible influx of plovers from the U. S. (Plissner and Haig 2000a), excluded from their breeding habitat because of high water on the Missouri River. The Saskatchewan and Alberta populations appear to have benefited from this dispersal, as both showed an increase in plover numbers from the 1991 census, 15.0% (Skeel et al., this technical report) and 53.3% (Bjorge and Murphy, this technical report), respectively. However, Manitoba and Ontario (Lake of the Woods) numbers declined by 25% (Asmundson and Jones, this technical report) and 40%

(Heyens, this technical report), respectively. Manitoba's population was at least 50% lower in 1996 than the highest historical count. Wet conditions in Manitoba have contribute to reducing nesting habitat availability (Asmundson and Jones, this technical report), which appears to be an important current limiting factor in this province. Ontario (Lake of the Woods) continues to have a very small breeding population (Heyens, this technical report) which is vulnerable to the challenges faced by small populations.

Despite the increase in the Prairie Canada population, the Northern Great Plains population of which Prairie Canada is part of, experienced a 5.3% drop in numbers from the 1991 census (Plissner and Haig 2000a). One explanation may be that management efforts have not been sufficient enough to offset factors causing a regional population decline. In Prairie Canada, the breeding population is widely distributed over nearly 1400 km and so effective management is a major challenge. In Eastern Canada, plover numbers were (17.1%) lower than those of 1991 (Plissner and Haig 2000a). This decrease is of concern, given there was an overall increase in the U.S. population component and management efforts in Eastern Canada have been intensive. Relatively high fledging success in the years prior to the 1996 census (D. Amirault, unpubl.) resulted in an expectation of a regional population increase. If plovers short-stopped in 1996 along the U. S. Atlantic coast, this could account for lower numbers in the Maritimes. However, if Eastern Canada plovers did not short-stop and if they winter elsewhere from U. S. Atlantic plovers, it may signal problems during migration and/or on the wintering grounds, or a significant time lag from the time birds fledge to the time of return for nesting.

With only about 42% of the wintering birds located (Plissner and Haig 2000a), biologists continue to need to be concerned about the security of the plover on its wintering grounds. Not knowing where these remaining birds are, means the wildlife agencies are unable to assess habitat security, identify/mitigate threats and determine plover use patterns of these areas.

Future recovery efforts

With less than 2,200 Piping Plovers remaining in Canada's population and no evidence of renewed colonization of historical breeding habitat in Ontario's Great Lakes, Newfoundland's west coast, the Lower North Shore of Québec or the Gaspé peninsula, biologists need to evaluate past conservation measures (Goossen 1990, Flemming and Gautreau 1994) to determine their effectiveness so to ensure recovery of the species. Better coordination is needed among agencies to make management efforts as effective and efficient as possible. The role of recovery teams and associated working groups will be critical to strategic and targeted management. Canada's participation in the International Piping Plover Working Group, has the potential to strengthen and focus international management needs and concerns. In Prairie Canada, adult and juvenile survival rates need to be determined to aid population modelers in their quest to understand the plover's population dynamics and determine the productivity level required to attain population stability in the Prairie Canada/Northern Great Plains population. In Eastern Canada, similar challenges are faced. Research must be initiated to determine why Eastern Canada numbers continue to decline despite high reproductive success. Efforts aimed at changing public attitudes must be continued in order for recovery programs in Eastern Canada to have any chance of success. Chick loss, presumably from predation, continues to be a major impediment to increased fledging success. The challenge of managing predators faces all North American regions where the plover breeds. Creative and innovative solutions need to be found to maximize plover productivity.

The wintering locations of Eastern Canada and Atlantic U. S. birds needs to be further clarified. If most Eastern Canada birds winter separately from U. S. plovers, then it becomes more important to initiate cooperative protection, research and management opportunities with those countries where Eastern Canada plovers winter. More effort needs to be focused on identifying wintering areas for all North American Piping Plover populations given continued tourism, business and housing developments and the low numbers of plovers accounted for during winter censuses.

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